THESIS FOR THE M.A. EXAMINATION.

APRIL 1932.

" AN ANALYSIS OF THE GEOGRAPHIC FACTORS AFFECTING AGRICULTURE AND INDUSTRY IN THE SOUTH-WEST PENINSULA WEST OF THE TAMAR."

--ooo--

Submitted by

S. MUCKLE.

S. Hunt Co

AN ANALYSIS OF THE GEOGRAPHIC FACTORS AFFECTING AGRICULTURE AND INDUSTRY IN THE SOUTH WEST PENINSULA WEST OF THE TAMAR.

PART I.

Introductory chapters dealing with the major geographic factors which influence economic conditions.

Chapter 1.

A general consideration of the factors of relief and geological structure which influence human activities within the region. Special features of the coast, peculiarities of drainage, ancient platforms, and glaciation.

Chapter II.

An analysis of climatic conditions stressing the equability of temperature, and the excessiveness of the rainfall accompanied by a high relative humidity and cloudiness above the average.

Chapter III.

Typical Cornish soils - their varied nature, properties, and general distribution.

PART II.

An examination of each industry on a geographic basis of correlation with Part I.

Chapter IV.

The predominance of agriculture. An analysis of agricultural maps showing the degree of control exerted by each of the factors. A geographic interpretation of the map showing percentage of population engaged in agriculture.

Chapter V.

General conditions of the Fishing Industry. An analysis of a series of graphs showing the general downward trend of the catch at each station in recent years. The pilchard and oyster

fisheries. Analysis of map showing percentage of population engaged in fishing.

Chapter VI.

An account of the past and present conditions of the mining and quarrying industry with illustrative graphs of production. Economic difficulties. Analysis of map showing percentage of population engaged in mining and quarrying. The tin and copper mines. The china clay quarries.

Chapter VII.

Some consideration of other industries including the tourist industry.

PART III.

Development of the region as controlled by its economic life.

Chapter VIII.

Population and transport conditions. Population groupings. Falmouth harbour proposals of 1919 Act. Road developments and omnibus services in relation to new building areas.

Chapter IX.

The future of the region with special reference to the mining industry. Significance of the Regional Planning Scheme.

CONTENTS.

PLATES.

(Reduced from Original Maps.)

ILLUSTRATIONS.

X These are original illustrations.

PHOTOGRAPHS.

(Taken by the Examinee in 1931).

Introduction.

The south western peninsula of England has been chosen for discussion since it forms a most interesting geographic unit. This is true as regards the type of agriculture and peculiarly characteristic industries. The general condition of agriculture - a primitive cereal development, low percentage of total acreage available for arable use, extensive permanent grasslands, and considerable expanses of moorland - are similar in the three western Counties of Devon, Somerset and Cornwall. In Cornwall, however, a more marked development of intensive farming is found with local specialisation in the extreme south western districts. With regard to industry Cornwall possesses a distinctive pilchard fishery, tin and copper mines and china clay quarries. Both Somerset and Devon are arable and pastoral to a greater extent. Cornwall is in many ways different and the region chosen has, therefore, been restricted to west of the Tamar River since this is in many ways a geographic unit. Isolation has played and still plays a great part in preserving the personality of the region. The link with Brittany is closer and of longer standing than with other parts of England, to which the region west of the Tamar is in many ways foreign.

It was then decided to make a study of the Cornish agriculture and industries which are analysed on a statistical basis from the most recent figures available, many of which are unpublished. Part I is intended to show the nature of the physical basis, Part II the extent of the controls, and Part III the development which has resulted in the past and finally the trend which is probable in future years. The aim of the thesis is to show clearly the relationship between natural conditions and the economic development as it exists and to trace the probable trend of future development.

PART I.

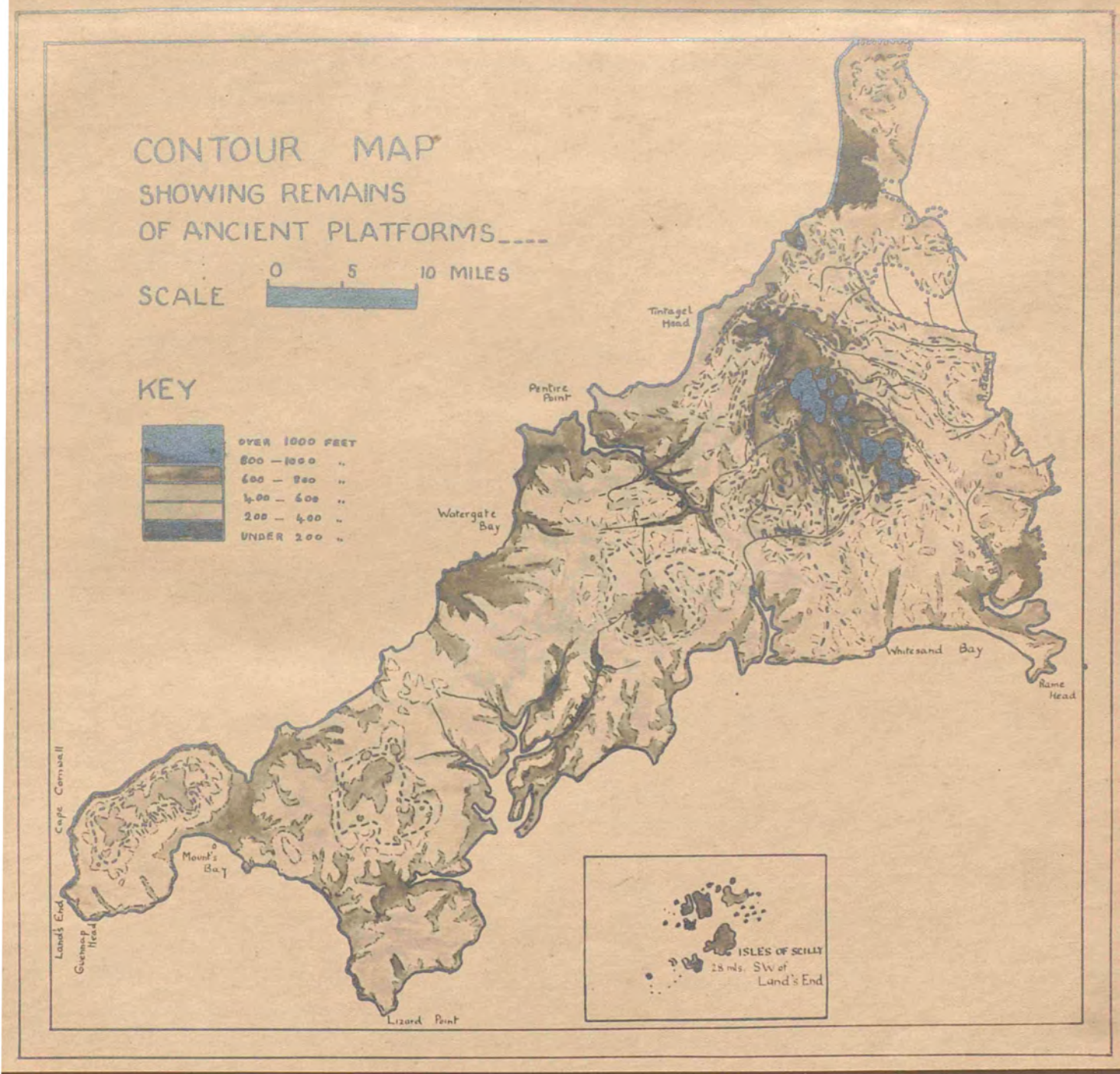


Plate 1. Contour Map.

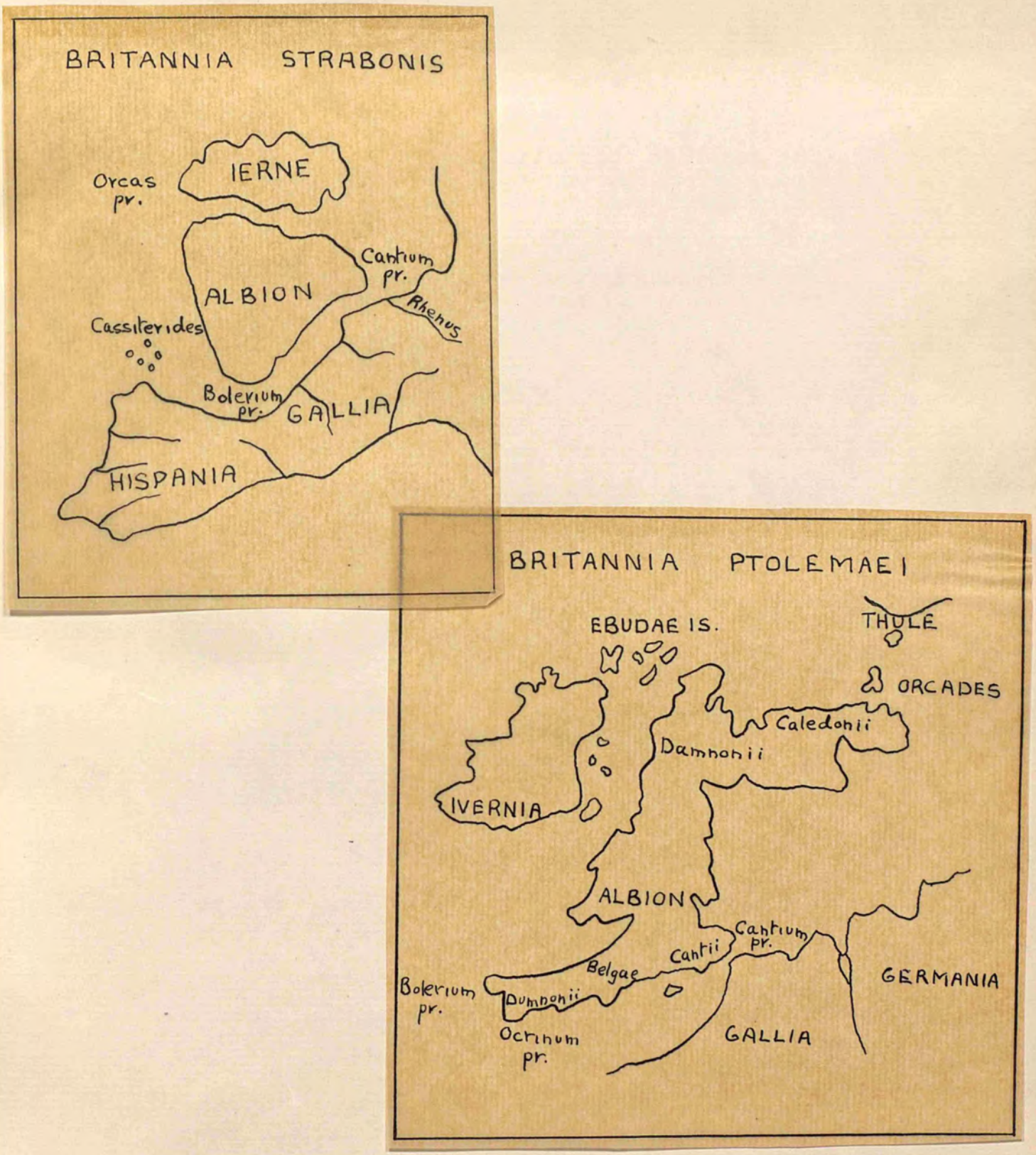
CHAPTER I. PHYSICAL FEATURES AND DRAINAGE.

General physiography.

Physically, if not structurally, the region west of the Tamar is characterised by two distinctive types of scenery; (1) the coast including the lower valleys, and (2) the inland moors. Both types are dissected by valleys which may be either deep, rocky and gorge like,as in many examples from the north coast, or wide and shallow, supporting a rich vegetation, as in the famous Luxulyan Valley and several southern examples.

Coastline.

With regard to the coastline the past no less than the present is interesting, and,therefore,the evolution of this feature must be studied. The authority for such changes is based on several maps from the earliest times to the present day. These together afford conclusive evidence of the changing coastline of south western England, which consequently had important results on the extent and nature of arable land, since the area under cultivation was constantly changing. As early as the second century Ptolemy's map shows the northern coast much further west than to-day. By the end of the sixth century parts of the west coast had been submerged beneath the sea and the lost land of Lyonesse became merely legendary. It is reputed to have been a land of great fertility uniting the



Illustrations 1 and 2. Maps from Smith's Ancient Atlas.

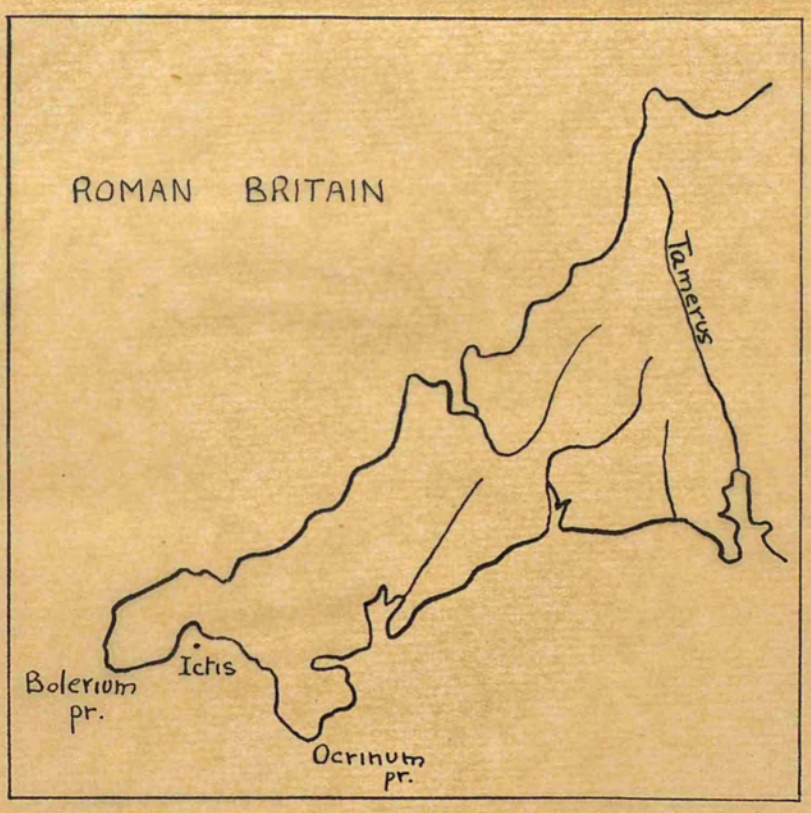


Illustration 3. Map from Smith's Ancient Atlas.

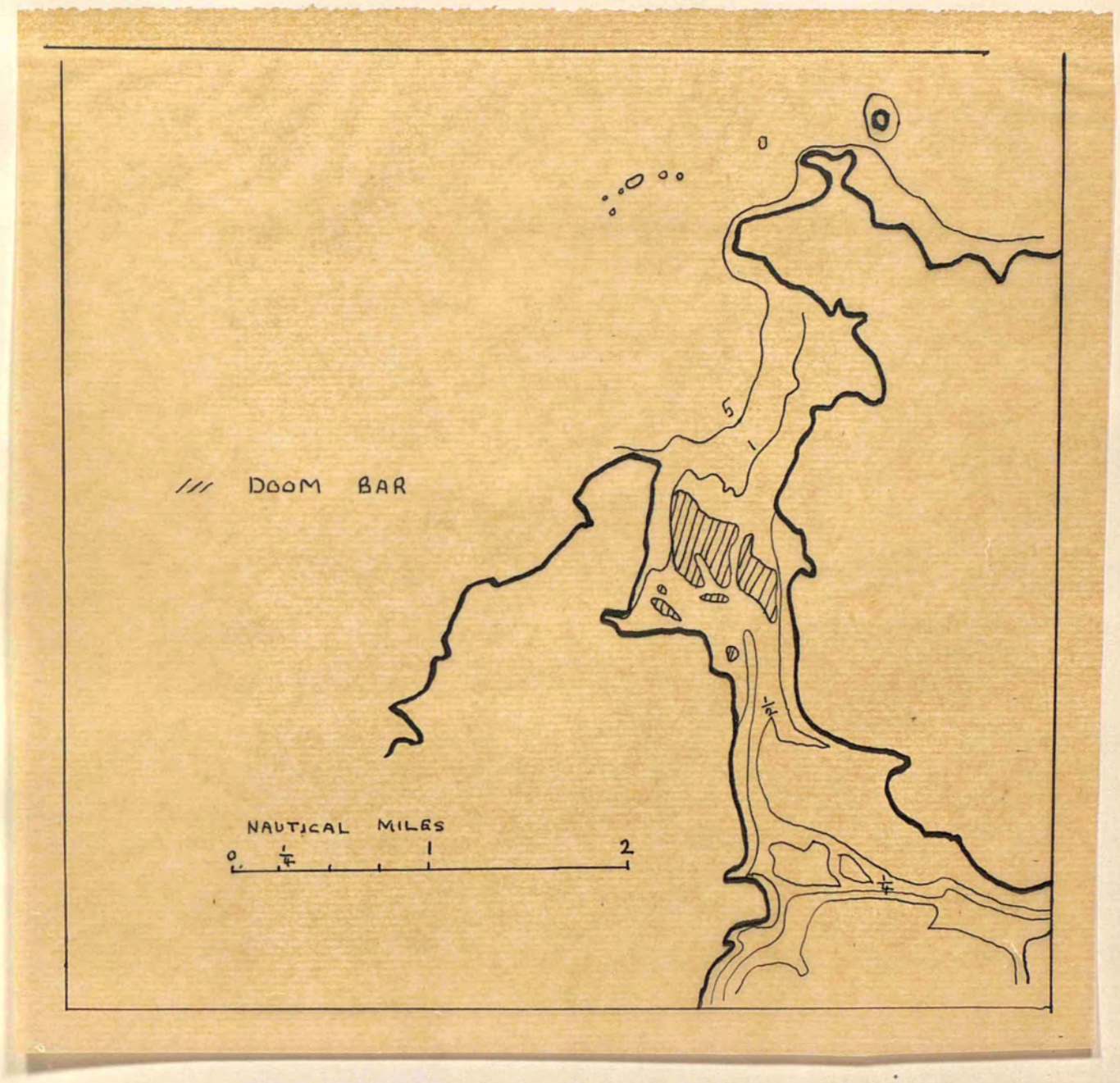


Illustration 4.

Padstow Bay from Admiralty Survey of 1849.

N.B. Shallow water and sand banks in Doom Bar across mouth.

Camel estuary looking towards east from left bank showing:-

1. Shallow wide mouth with sandy flats - Doom Bar right across mouth.
2. Sand dunes and "towans" (planted) on left - very mobile.
3. Gentle grass covered slopes.
4. Narrowing at Wadebridge.

Scillies with the mainland. About 1000 B.C. it was a rich and flourishing land to which Phoenician traders came. The site of the then largest city is marked by the Seven Stones. From statistics on the authority of several writers it is probable that the submergence was effected by several inundations and was not sudden but gradual. In the time of Edward I the area was about 1,500,000 acres and in 1760 960,000 acres. In 1014 Dr. Guest in his "Origiones Celticae" states "the sea flood came widely over the land and drowned many towns and a countless number of people." The ancient coast line then is very different from that of to-day or even from that of Roman times. Studying the present coast a great difference is seen between north and south, as is also the case in Devonshire. Southwards from Hartland Point there is a southerly trend of about 15 miles with very rocky cliffs about 120-700 feet high, a much indented coast and numerous small but well-defined bays. From Cleve Point to Widemouth Bay and southward to Tintagel a cliff strand can be slearly seen. A striking feature along the north coast is the close relation between structure and relief which is remarkable when walking along this coast.There is a constant succession of hard strata forming headlands and softer strata which forms the bays. Pentire Head is formed where trap rocks occur; Padstow Harbour and the Doom Bar where there is a great extent of sandy waste and what are called locally "towans" on either bank, which are exceedingly mobile and have, as at St.

South west coast between Land's End and Cape Cornwall, showing:-

1. Rocky headlands alternating with sandy coves.

2. Poor, thin, grass cover.

3. Peneplanation - relic of 430 ft. platform near St. Just in middle distance.

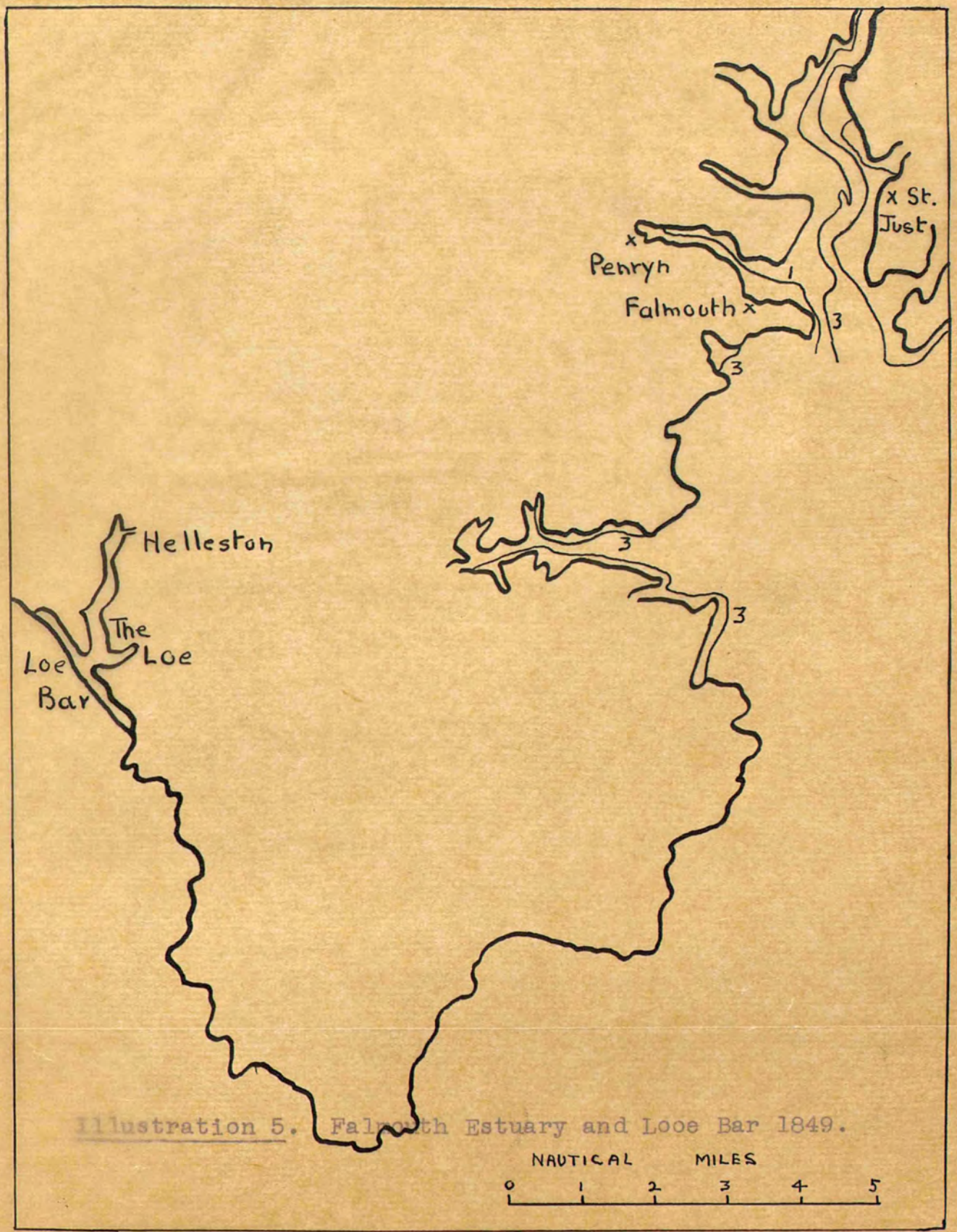


Illustration 5. Falmouth Estuary and Looe Bar 1849.

Looe Pool, near the Lizard, looking towards old port of Helston, showing:-

1. Shingle bar and salt marsh vegetation.
2. Site of Helston between spurs.
3. Tree growth on slopes; shelter.
4. Pastures on hillsides.

Edenoch, buried churches and villages. This rocky and indented coast is continued to Mawgan. In Constantine Bay blown sand is again seen and forms larger hills here. Watergate Bay has a sandy beach but no hills or "towans". At Perran Bay there is an embayment in hard slate rocks. Between Treamble and Holywell Bay there is much land covered by drifting due to the stopping of a small stream owing to mining operations.near Gear and also near Crantock. In the case of Perranzabuloe is an example of emergence since the church here was evidently covered by sand deposits. The wide bay at St. Ives occurs between hard greenstones and sandstones and slates. The sandy harbour of the Hayle estuary is of little significance. A typical cliff coast is that of the south west where low cliffs up to 200 ft. high occur, yet this coast is even more rocky and dangerous with many rocks offshore. The only embayment of any significance is Whitesand Bay.

With regard to submergence the very shallow waters of Mounts Bay and the low submarine contours shown round the Scilly Isles also are further indications of submergence. Small sheltered harbours are numerous as they are also in small inlets of the Lizard peninsula. The coast between Kynance Cove and Mounts Bay has wasted rapidly during the last half century. At Marazion a high bank of granitic sand has been formed. Rocky ledges and sandy strands are found eastward in addition to rugged cliffs. An interesting feature of the Helston district is the Looe Pool, now separated from the sea by a shingle

South coast between Looe and Fowey, showing:-

1. Gently sloping contours of the slate areas - contrast rocky coast of north and south-west.
2. Drowned coast; good shelter for harbours.
3. Hedges, grass cover, and farms close to sea.

Typical cove of south-west coast - Gunwalloe, showing:-

1. Sandy stretch.
2. Shelter.
3. Habitations on cliffs - also ancient church built into rock on right.

bar - in former days Helston was a river port. Farther east the chief features of interest are the evidences of drowned coastline resulting in the magnificent natural harbour of Falmouth. Fowey is good but on a smaller scale. Regarding oscillations of the coast it appears that a process of compensation has been going on and that a rising process was followed by submergence in Pliocene times. The evidence is the presence of both raised beaches and drowned estuaries in different areas. The extent of present disturbances is difficult to estimate.

The valleys are discussed in relation to drainage and the moors in relation to the ancient platforms.

Geological Structure.

The geological structure of the peninsula is simple in broad outline but very complex in detail, especially in the separate and distinct Lizard peninsula. Peneplanation in Tertiary times was accompanied by a tilt towards the south and, therefore, the north coast in contrast to the drowned south, is rugged and bleak. The present distribution of the geological formations is exceedingly important since, owing to the comparative absence of drift, this coincides with the soil distribution. Three types of rock predominate - sedimentaries, metamorphic and igneous (basic and acid) rocks. A concentric zonal arrangement is a special feature. With regard to the history of the region the greatest changes were accomplished

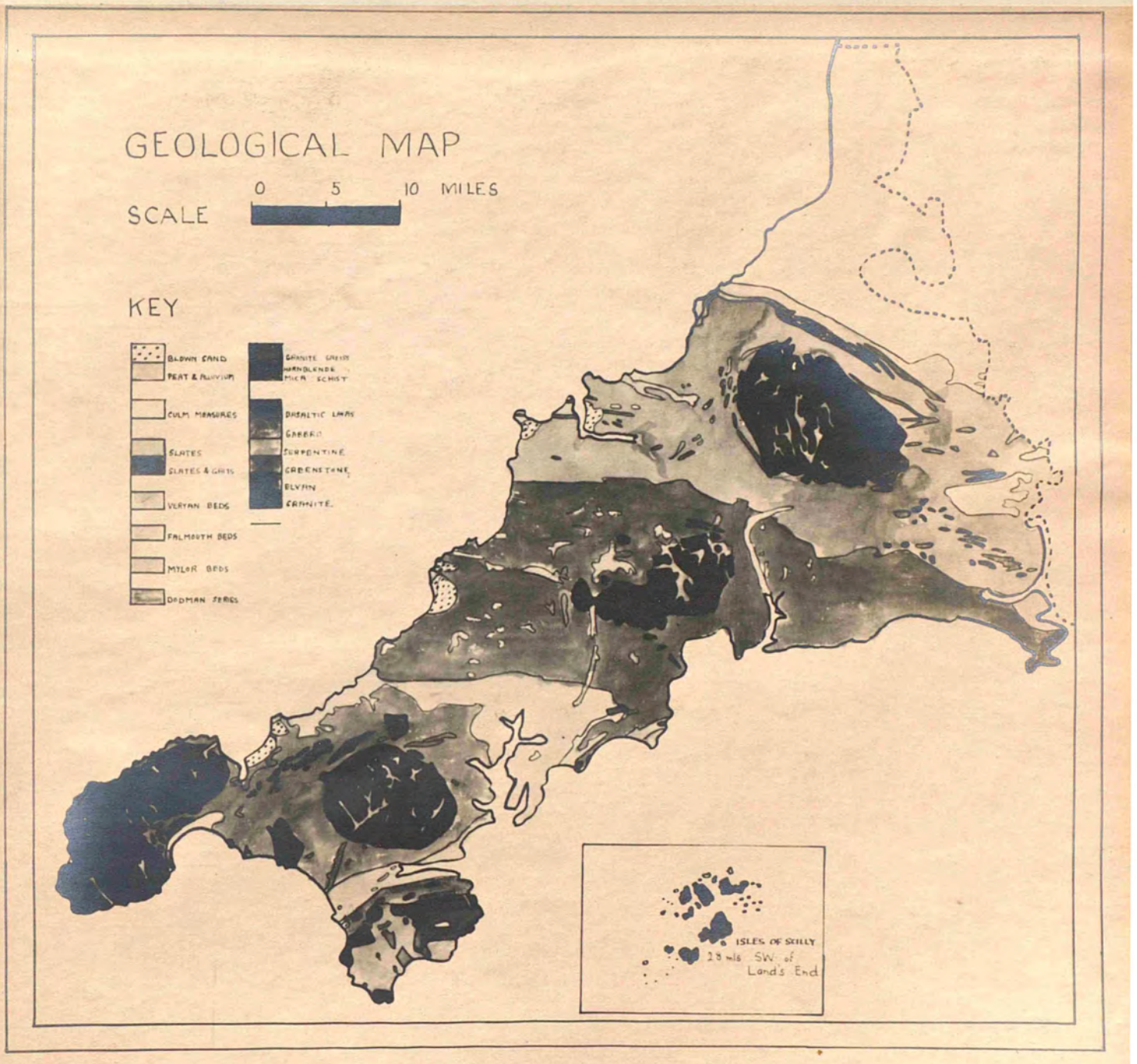


Plate 2. Geological Map.

in Mezozoic and late Carboniferous times. The granite masses were intruded in the late Carboniferous era when the slate cover was caused to "gape" in four places where granite domes arose. The dome formation was in all probability due to the forces of compression coming into conflict in this region and causing complexities of folding by intersecting folds - the Hercynian and the Caledonian folds. In Mezozic times there was a continuous highland area from the south western peninsula of Devon and Cornwall across into Brittany. In connection with the dome formation it is thought by Worth that Dartmoor is itself the stump of an old volcano and that these domes occurred above lava reservoirs which fed Devonian volcanoes and at intervals the molten mass was extruded. There is no evidence for taking Bodmin Moor as a similar case but the presence of extruded material points to the probable existence of an underground lava reservoir. There is a progression of younger rocks towards the east and a predominance of slates and metamorphosed killas.

With regard to detail the Lizard peninsula presents an area of great complexity. Briefly the order of events was as follows. The deposition of the Lizard Head series was followed by the hornblende schists of igneous origin, which are remarkably like the plateau basalts of Skye and which produced alteration by contact in the Lizard series. Next the non-resistant gneisses were intruded and followed by the sedimentary quartzite which was again followed by

Waterlogged area of the Lizard peninsula in the Serpentine west of main road north-south, showing:-

1. Flatness and barren, desolate expanse.
2. Lack of any farm or habitation.
3. No shrub or tree growth, evidently poor grasses only - a peat bog area.

"Cornish Heath".

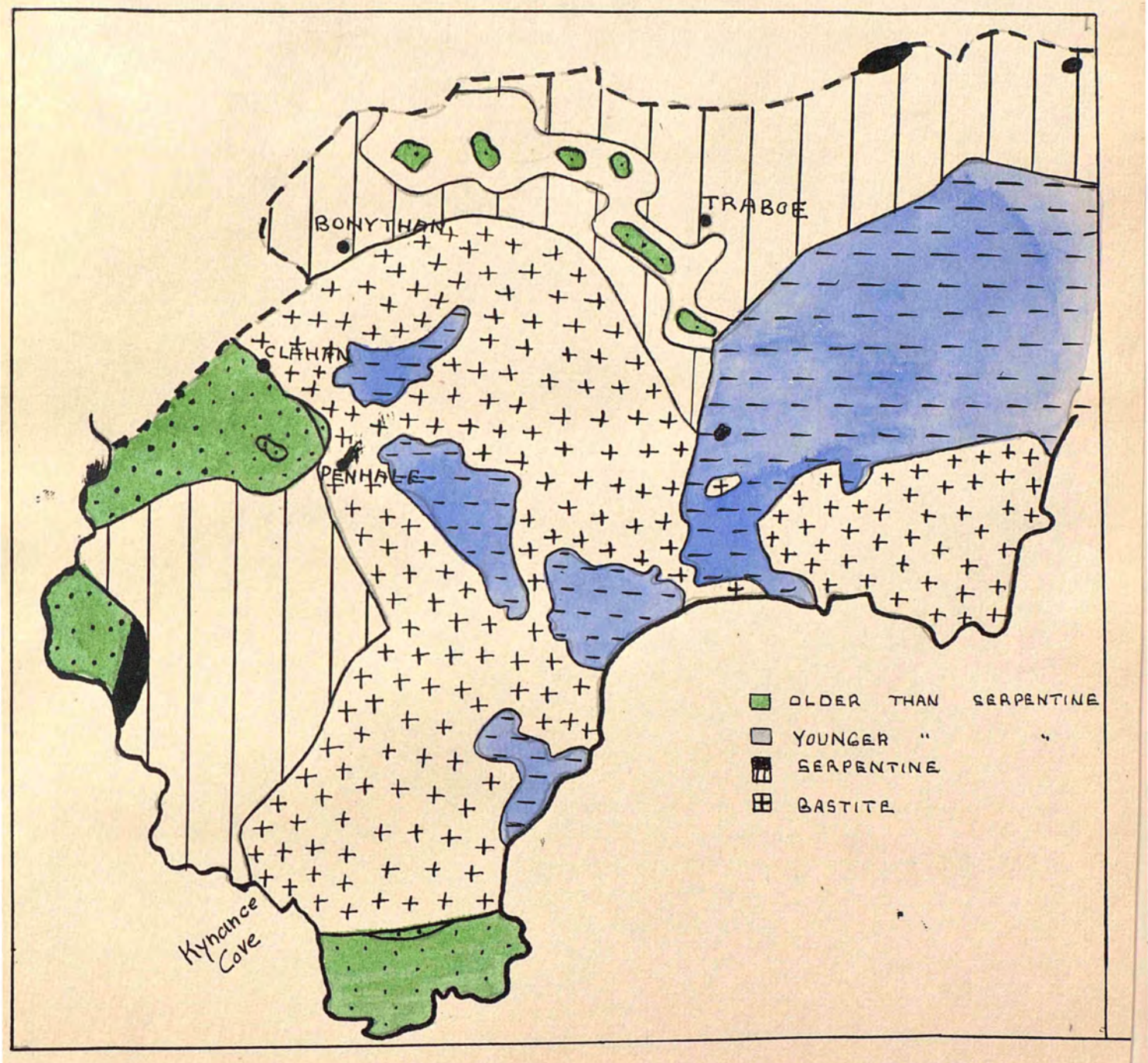


Illustration 6. Geology of Lizard Area.

intrusions of hornblende schists. The serpentine mass itself resembles in origin and shape the granite masses and is probably a great laccolite which also occurs at the surface at Bolt Head and Start Point in Devonshire and, therefore, possibly underlies the south western area. A concentric zonal arrangement is definable as before. The foliated schists and gneisses were intruded under pressure and foliated before cooling took place.

The detail of the Land's End area is less distinctive. There is a rather complex folding of sedimentary and igneous rocks. The granite outcrops are due to the presence of a great laccolite and the granite floor is nowhere very far below the surface. Fissures in the neighbouring material were later filled by hot gases which cooled to form veins of metallic ore.

Salient features of the Bodmin and St. Austell areas are the presence of an anticline which is general in the north and continued into Devon where it is exemplified in the Exmoor massif. This dates back to the Armorican upheaval. Later faulting was caused by compression of the rocks already cleaved. Granite intrusions and resulting metamorphism followed. Kaolinisation is best exemplified in this area especially on the Hensbarrow Downs. Several factors have here combined to form the greatest small scale china clay area of the world. The granite has decomposed readily in

situ and become deeply rotted or perhaps has been affected by the ascent of hot gases from beneath; the origin is still disputed. It is more likely that the kaolinisation has been effected from below since weathered granite is brownish in colour. Typical Cornish marsh areas can be seen at intervals where the granite mass is intersected by valleys having a narrow section where the sides of the hills come together and a broad section where waterlogging occurs and beneath a sheet of peat covering deposits of kaolin. Both factors may be at work but weathering seems of less importance. It is remarkable that the valley floors are mostly kaolinised however. It seems probable that the breaking down of the actual rock may be accomplished by weathering or from beneath with the addition in all cases of fluorine and boron vapours which further act upon the decomposed material. Kaolinisation is complete or incomplete when in this case an intermediate product - china stone - is formed. Of the Bodmin area the central and western parts show complete kaolinisation. There is a connection between the tin lodes and china clay areas and, therefore, further weight is given to the gaseous action theory.

The Padstow and Camelford area shows the results of metamorphism upon the killas rocks surrounding the granite. There is a general northerly dip which brings the Devonian beneath the Culm Measures. The Staddon Grits are slaty and sandy. Lava is seen at Pentire Head. Three types of killas

Illustration 7. High level platforms of Bodmin area.

rock are distinguished - killas in which alternations are very clearly marked, fine and silty killas slightly marked and killas not visibly banded. This last resembles the slates but does not show cleavage into thin plates. The impregnation of the killas is of considerable extent and the metamorphic aureole so caused is of a varying width of about $\frac{3}{4}$ - $1\frac{1}{2}$ miles in this area. Originally the killas was a fine mud with no foliation; the foliation is due to thermo metamorphism proceeding from the cooling granite area. The granite occurs as Tors which are solid and free from jointing; the main mass decomposed about 10 feet below the surface is the kaolinised granite. Marginal and radial dykes and also greenstones and epidiorites have been intruded. The Camel estuary shows very clearly the recent deposits of blown sand in the form of "towans" on either bank. River terraces are also apparent.

High-level platforms of the Cornish peninsula.

Occurring at at least three separate and distinct levels within the peninsula are relics of once more extensive old high-level platforms all of which are well above the present sea level yet suggest a marine origin. These curious, ancient platforms form yet another link with Brittany. They attain their maximum development on the Bodmin Moors and are

less easily traced elsewhere. Here they occur at levels of 750 feet and 1000 feet above the present shoreline. In south western Cornwall a platform is recognised at the 430 feet level. It is probable that this lowest platform was a shoreline in Pliocene times. The general plan can be traced but there are only fragments now left from which to construct the old shoreline. It follows that the area which saw the greatest development of the feature will show most clearly the character of the older scenery. Therefore the Camel - Davidstow Moor - Crowdy Marsh area is the best in which to study these ancient platforms. Much of the older scenery can be reconstructed when descending the Inney Valley after crossing the watershed. The younger or 750 feet one is higher up the valley and nearer the sea and is first noticed near Camelford. The general plan of this can be reconstructed. It stretches south-south-east near St. Breward but further to the south at the present day it is denuded. Its preservation in special areas is largely due to the greater hardness of the granite. To the north and east it is only found at the edges of the 1000 feet platform. In the neighbourhood of Bowithick it again becomes a prominent feature. Again it is seen, this time on the hard epidiorite, in the neighbourhood of Trewint in the south-east. South of Bodmin the platform is continued in the Conce and Red Moors. Alluvial deposits and marshes are noticed at

various places on the platform. The tin deposits are of special significance and interest and occur both above and below. Their nature in each case is different. When this was a shoreline granite detritus was above as also must have been the tin which decomposed before the platform was cut. After this happened, tin still later decomposed and this is to-day found below the platform level. It is shallow deposits such as these which have been worked for more than 1600 years. Whenever the tin deposit could lodge in hollows it decomposed in situ. In some places it is as much as 40 feet thick and very ancient. It is this tin deposit which points towards, but does not prove, the existence of glacial conditions in Cornwall itself. It has been suggested that the deposit was formed beneath snows when the southern area was flooded and there was an ice sheet somewhere to the north. This is still the coldest part of Cornwall. There is some evidence to substantiate this. It is known there was a snowfield and a radial arrangement of granite boulders from Roughtor Moors and crags. The inference is that the rocks slid down the snow slopes. At the higher levels the ore is fine-grained and less concentrated and, therefore, of a lower grade. Unsorted wash is worked on the hillsides. Wolfram is now more valuable and is worked in addition to tin from which it can be separated by electro-magnets. In this connection the

discovery of a wolfram deposit at Buttern Hill is interesting. It occurs at the edge of Bowithick Marsh and extends up the slope. The depth of 6 feet is reached in the centre of the hollow. Above this is fine recent wash. Granite blocks which are older and probably slid down the slopes rest on peat at the base,which is about 2 feet thick. The interesting facts regarding the deposit are first, that it occurs above 750 feet, and second, that it was decomposed long ago when protected by snow. Adjacent hollows of unsorted wash were thus enriched by the downwash of the tin concentrate.

Another new working at Kenton Marsh is also similar. The peat cover is here about 15 feet thick. Recent wash is also seen with a tin deposit below this. This deposit must have been formed in the cold period as before and is richest below the general level of the shelf. The patches which remaindd were waterlogged since the climate changed and there was a great rush of water which prevented this deposit above the basal gravels. When the rainfall was less the flats became filled in and, therefore, the level of the recent stream was raised above the base of the hollow and consequently to-day pumping is needed. The tin in this case is below. Working of this deposit began downstream below the marsh, where was a greater fall. Small and very primitive artificial channels were made.

Similar deposits occur near Fowey Well.

There are deposits above 750 feet at Stannan Marsh where stream works are noticed.

In several cases the extensive marshes on these floors are valuable for china clay works.

The youngest of the three platforms and probably fixed as of Pliocene date occurs in the south west only at levels between 430 feet and 420 feet. This platform has been definitely established as of marine origin. The upper limit is marked by a steep bluff. The valleys in this region are interesting and show signs of uplift and consequent deepening and cutting back which becomes less marked as these are ascended. The platform rises to a bluff and bolder sea cliff above 420 feet. At Trendrine Hill sea cliffs are seen at 805 feet. Remnants of the platform are still preserved in the Land's End area and also in Tregoning and Godolphin Hills. Cliffs are here not above 300 feet. From the sea a singular aspect is presented. The dominant features are a strong bluff facing the Atlantic, a plateau sloping to the present sea cliff, with remnants of the old shelf. As the sea cuts back the cliffs become higher. This general curve is a feature of West Cornwall. Raised beach is found where there is a notch above sea level in this vertical cliff, probably of Pleistocene origin. The drainage is mainly underground

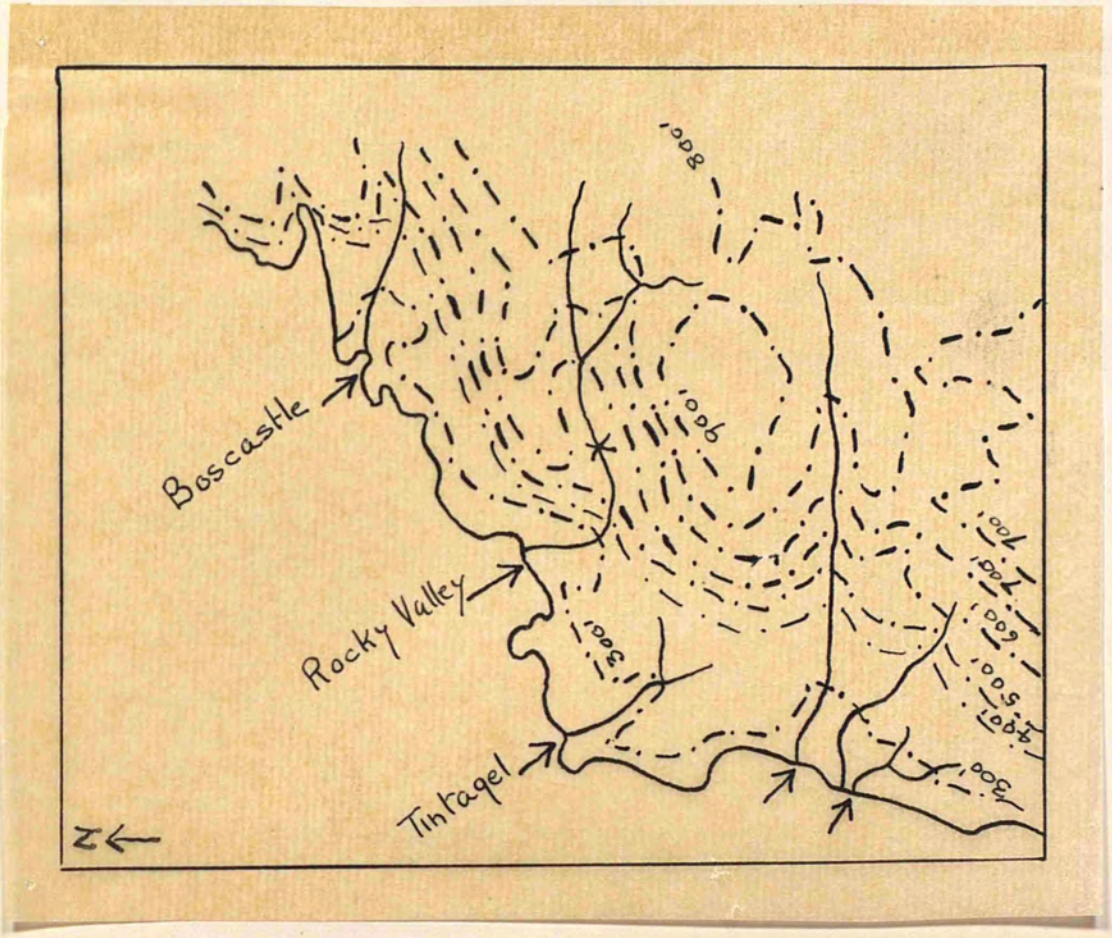


Illustration 8. Typical North Cœst Valleys from Quarterly Journal Geological Society.

since the area is too narrow and isolated for the development of a drainage system proper. It is a true fact in the case of the 420 feet platform that wave action was the potent factor and, therefore, in old Pliocene times either the platform was originally cut or merely accentuated. Thus the 420 feet contour at that date marks the shore line. The curious slope above the cliff has been assigned to the newer Pliocene, and the rapid cutting back to the Pleistocene. The older features are still clear and unless having undergone change by the action of frost and ice there is little change on such rocks as these.

Drainage.

There is a close relationship between these old high-level platforms and the gorge-like nature of some of the streams of the north coast especially in the Boscastle-Tintagel area where peculiarities of drainage are due to the presence of these platforms. Conditions generally resemble those of a glaciated area, but such features can be and are produced by rapid uplift when the rivers are rejuvenated and cut back and deepen more rapidly than they widen their beds. Thus are formed gorges and hanging valleys, and young V shaped valleys within mature U valleys are a feature of the north coast of the peninsula. The gradient in the neighbourhood of Tintagel is about 1 in 13. Here the gorges are incised in the 430 feet upland platform. There is clearly

A.

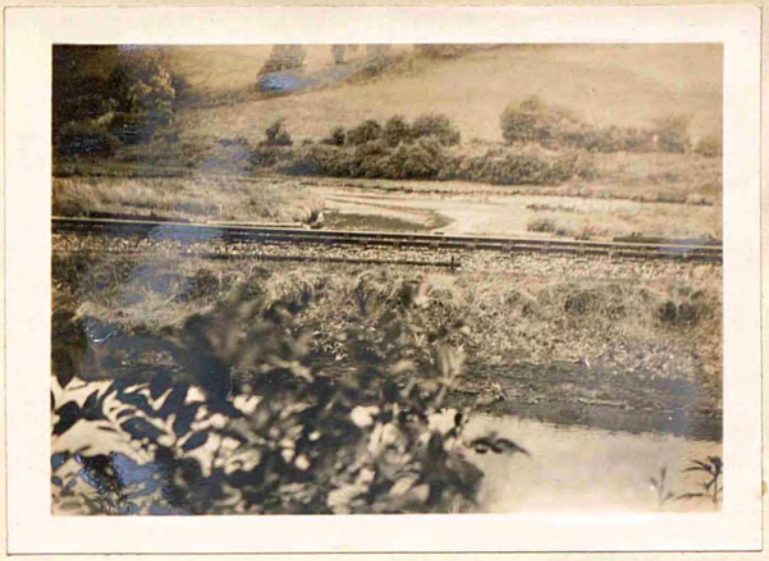
B.

North coast formations showing:-

1. Deep gorge and overhanging cliffs.
2. Slates A - bedding and cleavage.
3. A - probable "sea-breached" valley.
4. B - marble cliffs - foliated.

marked a contrast between the two types of scenery. Other valleys,or in some cases parts of the same valley, are in diversified hilly areas. To the west of the high ridge short drainage systems to the sea once united with a larger valley, now drowned. At several places along this coast examples of so-called "sea-breached" valleys are to be found. This is the outline or general plan of a once grander drainage system. The gorges are sinuous because the land was not uplifted slowly and gradually but occurred in two definite stages. The Tamar in its winding course shows this exceedingly well since here are a series of loops within a deep gorge. The loops were made by a slowly-moving, sluggish, stream across a flat area. Consequent on uplift the stream entrenched itself with the above result. At the period of emergence it is probable that Cornwall and Devon appeared as a step-like series of flats with rocky tors separated by steep slopes and drained by sluggish streams. As elevation continued deeper gorges were made with increased downward and backward cutting. The north Cornish streams are characterised by a series of waterfalls at the cliff edge which have cut backward and downward to form gorges. The very numerous small "potholes" have assisted in literally drilling out such chasms. From a distance the area seems an expanse of level fields but in reality is a series of flat-topped blocks separated by rocky chasms which in every case

are gorge-like and have steep rocky sides with overhanging crags. The Pentargon valley merely shows the early stage of a gorge in carboniferous grits and shales. The Valency River in contrast is very deep and swift, flowing, the drowned mouth of which is Boscastle Harbour. The Rocky Valley is an example of a gorge due to the cutting power of the coastal waterfall, consequent on post-Pliocene uplift. The old cliff line was itself breached. At St. Nectan's Kieve is a "bowl" and waterfall with a drop in this case of 40 feet. A series of falls occurs down the valley towards the coast. Other valleys of the region are similar. The Luxulyan Valley is an incised gorge in the plateau which is a notch at 400 feet yet a wooded ravine 100 feet deep. Various headstreams of the Fowey have cut V's within U's owing to uplift and consequent rejuvenation. Changing course of streams is another feature which argues for uplift as that of the Fowey River. The eastward course towards the sea was the original direction followed later by a westward course past Goss Moor to Newquay Bay and still later by a southerly course as at present. It has been shown that these changes in stream direction coincide with the 750 feet and 430 feet plateau epochs. There also exists evidence for a pluvial period contemporaneous with a glacial epoch when the swollen Fowey swept away all gravels and deposited tin and wolfram only; now the fine and coarse sediment is 20 feet thick.



A.

Upper Looe.

B.

Upper Fal.

Valleys of south Cornwall showing:-

1. Shallow and winding nature, especially B.
2. A - wide and flat floored with mud flats along rail line - swamp growth.
3. Well wooded in patches.
4. Intensive cultivation on valley floor near Truro. B taken from main line.

The physiography of the south-west of Cornwall is just as peculiar but entirely different in character. The events consequent on uplift are similar but the drainage itself is here very complex. Briefly there are three main valley types; the V shape as in the case of the Hayle River and streams west of Porthleven, the V valley incised grading with a point above sea level as in Kennack Bay and below sea level as in the case of the Looe and Helford Rivers, and streams east of Porthleven where wide, steep-sided valleys and meandering streams are found as at Gunwalloe, Poldhu, Cober and Porthleven. These are the oldest topographic features and can be seen again in the St. Ives - Mounts Bay Strait area. Here also the streams were larger in the pluvial period. With regard to hanging valleys, two types occur here such as the"reversal hollows" which are above stream and dry and valleys between Porthleven and Marazion such as that of Trequean which is U shaped, deep and winding with which the granite masses have interfered and, therefore, radial drainage resulted. The Perranuthnoe Valley clings to a clay cliff with embedded boulders, perhaps derived from raised beaches.

Glaciation.

The subject of the glaciation of the Cornwall peninsula is still a controversial one. Glaciation in a very limited sense undoubtedly did take place but the extent to

which, if at all, Cornwall was itself covered by an ice sheet is still largely a matter of conjecture. The glacier which is most likely to have influenced this region is the Irish Sea glacier, which fanned out in this region. However probable this may seem yet the evidence which exists in favour of the argument is scanty as yet. The only true proof is the finding on several headlands in the Scilly Isles of remnants of the ground moraine which has yet to be discovered on the coasts of Devon and Cornwall. The presence of "erratics" on these headlands, therefore, proves that this glacier at any rate approached these islands. The material may have been carried by the floe ice which was thrust up on to the land by the pressure of the ice sheet to the north. Glacial deposits are not lacking in the region, since in the Scilly Isles chalk flints and in the west of Cornwall drift are found. The top of these "head" deposits are of an iron-cement nature; the flints occur in ferruginous material. White Island at the north-western end of St. Martin's now shows an abrupt cliff where once was a granite ridge flanked by softer rocks. Trenches can be clearly seen along all lines of weakness in which these superficial deposits can best be studied. Beginning at the seaward end and passing along a trench the following deposits have been found - "head", iron-cement, lower head, old beach, and a sloping granite surface. On crossing the low bar separating St. Martin's very many

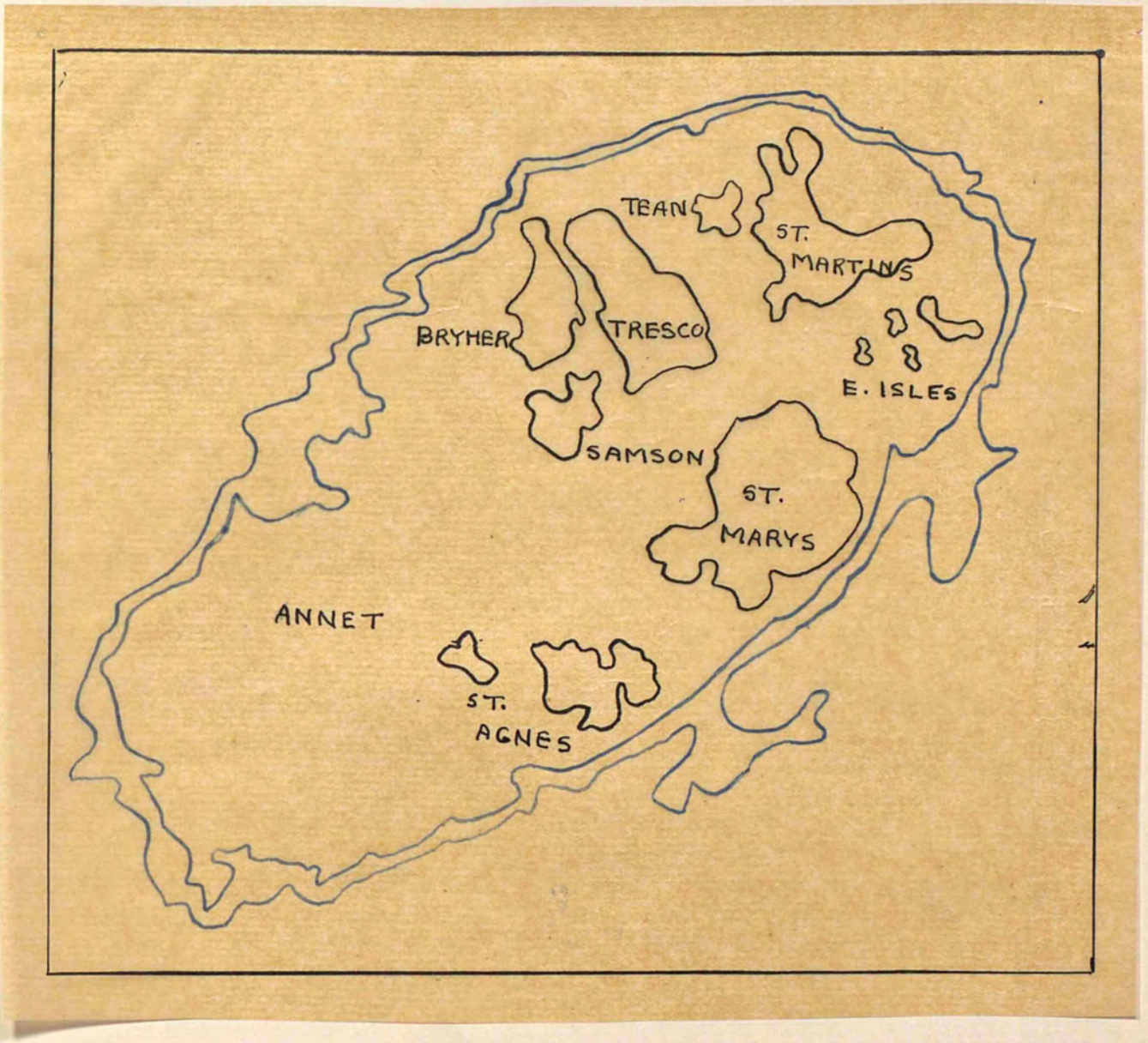
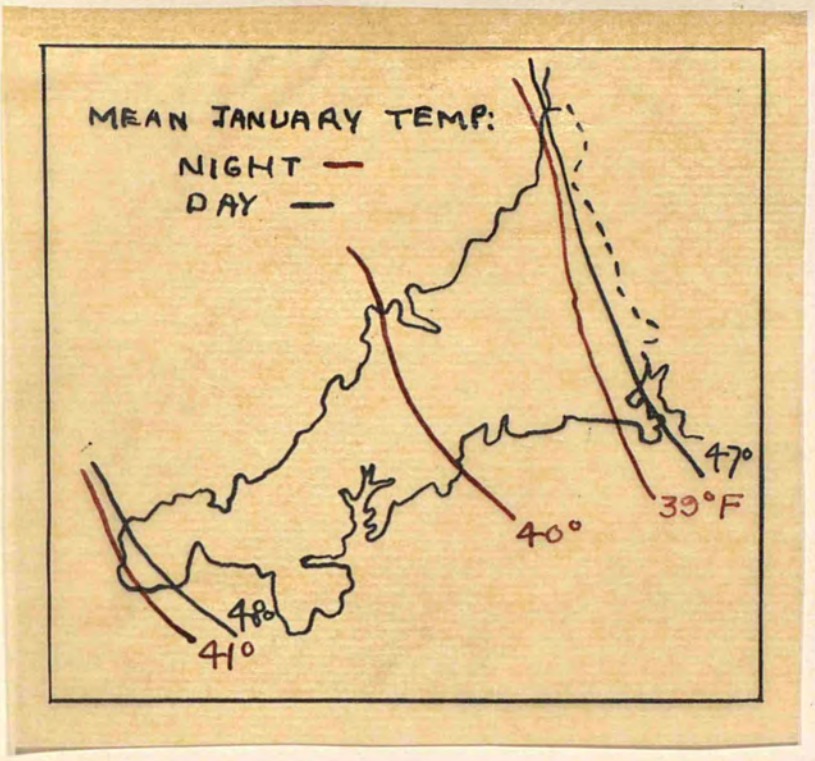


Illustration 9. The Scilly Isles and Submarine Contours.

erratic blocks and stones are found, thus proving a once greater extent of the glacial deposit. In St. Martin's Bay the deposit is now 30 feet thick. Foreign pebbles can also be traced on the east side again, north-west of Higher Town. These pebbles are embedded in the clays and iron-cements but are extremely rounded and, therefore, not derived from the parent rock but from an older deposit, probably gravel. The following deposits have been noticed here - chalk flints, greensand chert, soft reddish brown sandstones, rocks derived from a granite aureole, hardened killas, harder sandstones with rounded pebbles, pale green igneous material not connected with the post-carboniferous granites. Thus there is a certain degree of similarity in the deposit at different places. It is, however, the distribution which is most interesting and likely to be of value in tracing the probable history of these islands and the neighbouring peninsula. A belt can be traced in which these deposits are found including the deposit of "head" connected with St. Martin's, the west and south-west of White Island, north-west of Tean, west and north of St. Helen's, the north end of Tresco and the northern end of Bryher. In every case the level of these deposits varies only from a minimum of 100 feet to a maximum of 200 feet above the present sea level. Deposits also occur at the southern end of Samson Island. Other proofs of the presence of ice at some period include a number of striatons, the curious distribution of the deposits

themselves, and also the fact that the belts up to the 100 feet level end abruptly towards the south and, therefore, must have been ice-carried on floe-ice, as before suggested, which on reaching the projecting headlands broke up, became packed and heaped up until a trail crossed the headlands mentioned above. There must have been powerful wind or current force which swept the ice against the northern and western sides of the islands leaving the southern and eastern sides mainly free. A further proof, although of lesser value, is the curious distribution in lenticular patches of these foreign materials. Such arrangement is only found in regions where great dynamic action of some kind has taken place such as in this case the break up of an ice floe. It is well known that such arrangements are a feature of Irish topography where ice action on a large scale is proved. Another curious fact is the resemblance of the "limon" of Brittany to the stoneless iron-cement which is found on these island coasts. In both cases, the deposit is found above the "head" at the higher levels of old beaches and in both cases also it has the curious property of "setting" when dry and of forming vertical walls.

Thus, since the evidence regarding the glaciation of the Scilly Isles is more or less conclusive, the Cornish peninsula may itself have been glaciated to a slight extent. Several factors point to this but definite proof is not yet available.



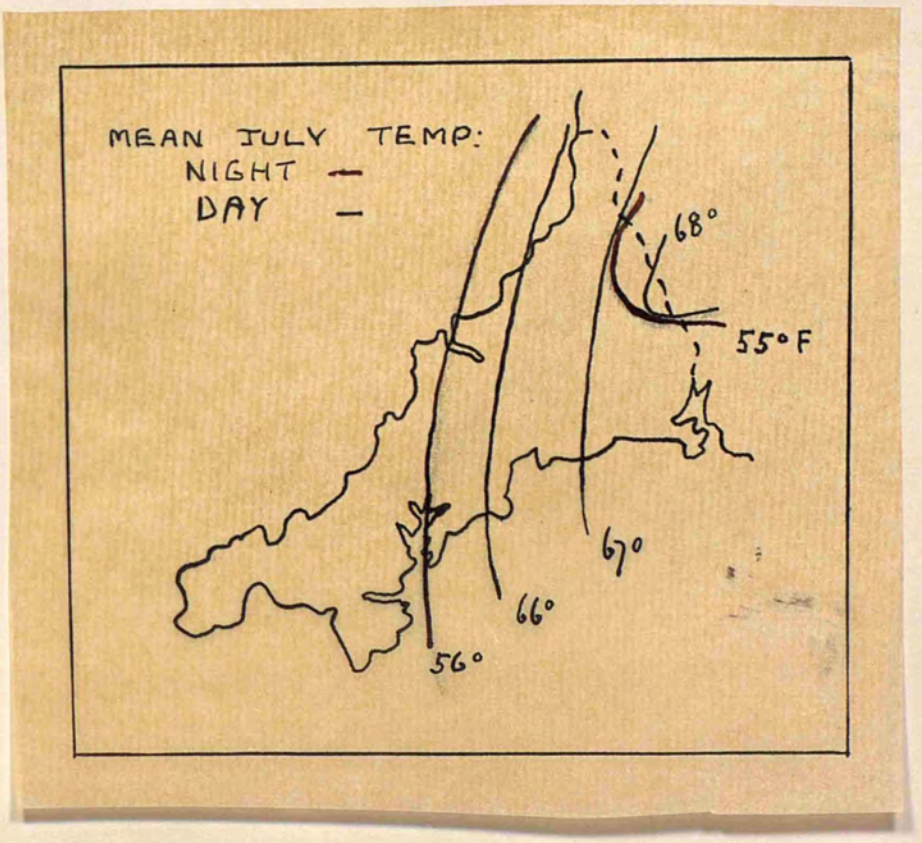


Illustration 10. January and July Isotherms.

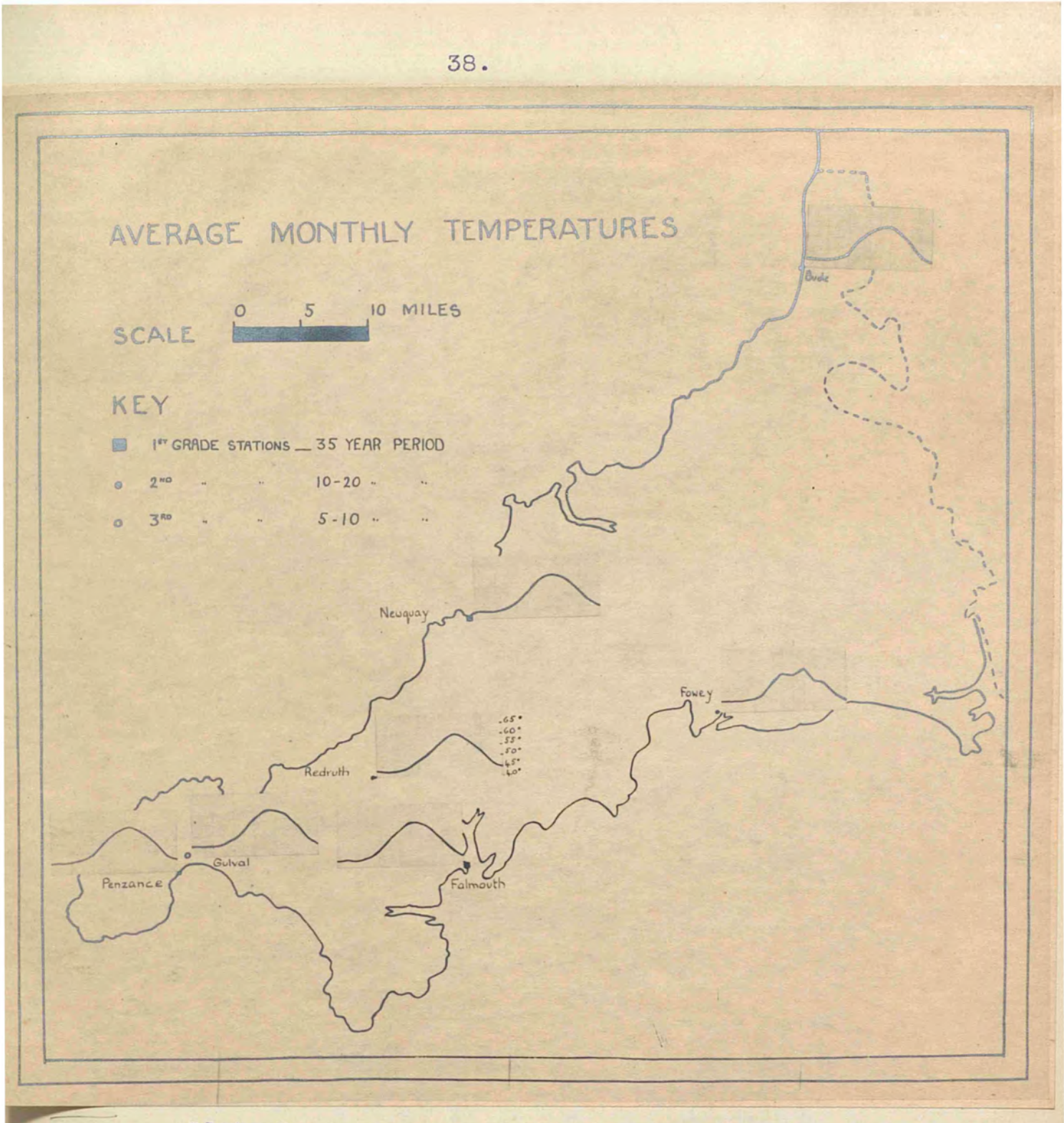


Plate 3. Average Monthly Temperatures.

(a) Great similarity of curves.
(b) Maximum temperatures in August.
(c) Early spring and late autumn.
(d) High winter temperatures.

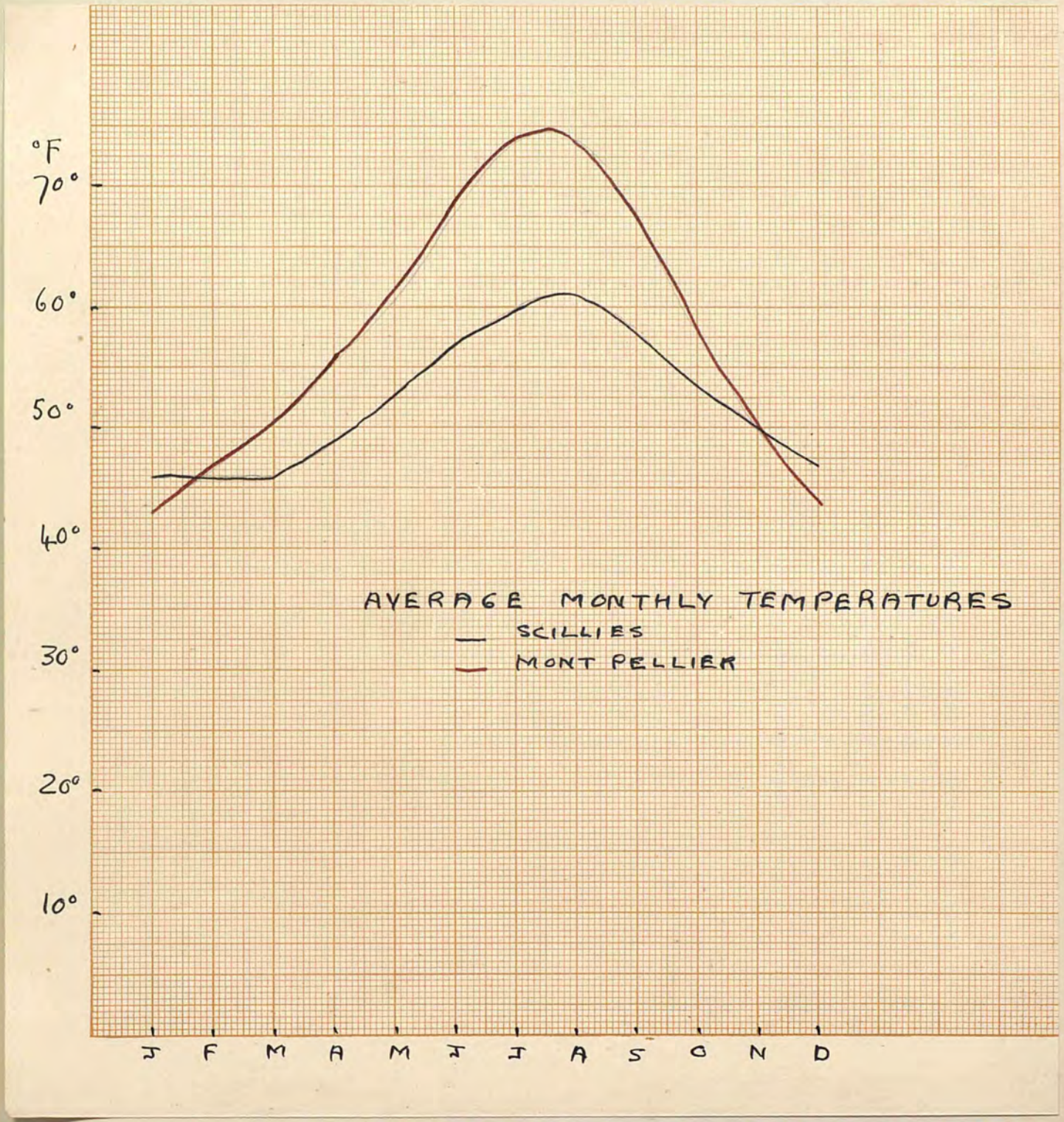


Illustration 11. Graph of average Monthly Temperatures.

CHAPTER II. CLIMATIC CONDITIONS.

Temperature.

A consideration of the temperature conditions reveals the fact that of the three controlling forces - latitude, altitude, peninsular location - the last exerts the greatest degree of control except perhaps in the case of Bodmin Moor where this is cancelled by the forces of altitude and greatest width which work together. In all other districts of the peninsula a marked uniformity prevails. This is best seen by a graphic analysis of temperature averages over a period of years for different stations within the region. Of these the figures available for Newquay on the north coast and Falmouth on the south coast are most reliable and cover a uniform period. It is, therefore, possible to study the graphs in some detail. Taking the Newquay graph, the very striking fact is the great analogy to conditions at Falmouth and at once indicates equability. This equability of temperature is proved, at any rate for representative stations of the northern and southern coasts, by the flatness of the curve in both cases, which is remarkable. Newquay is apparently very slightly warmer in autumn and slightly cooler in spring and summer than is Falmouth. Winter conditions, at least for the January - March period, are in both cases similar. In the late autumn and early winterNewquay is a few degrees warmer

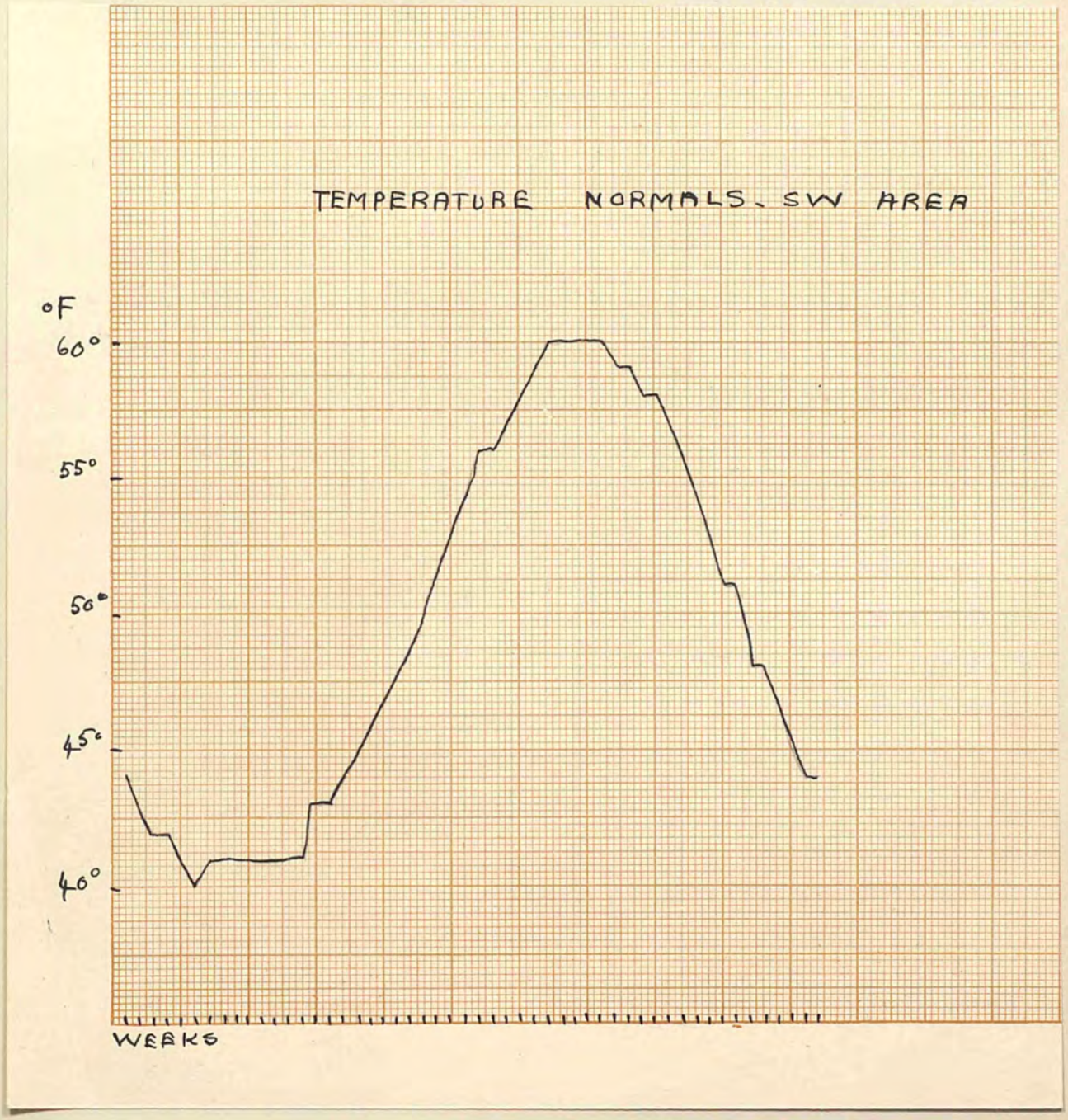


Illustration 12. Temperature Normals for south-west area.

a few degrees cooler in summer and, therefore, slightly more maritime than Falmouth, which owing to its rather enclosed location is less tempered by the sea. Falmouth can be almost enervating in summer whilst Newquay enjoys delightfully bracing Atlantic breezes. The yearly range is only 5.3°F between a maximum of 50.5°F and a minimum of 45.2°F. The coldest months are January and February. There is a gradual rise in temperatures until 50.5°F is reached in both July and August. The autumn begins in late September with an average of 49.7°F recorded. There is a gradual but rather more sudden change in temperatures than was experienced in the earlier part of the year. The drop, however, is still very gradual and at the end of the year the lowest temperatures of the beginning are not again experienced. Between the months of December and January there is a drop in temperature of 6°F so that the winter itself, though short, is rather sudden.

A comparison of temperature conditions for the south-west and the south-east is interesting since this throws some light on the importance of agriculture in the south-west. The mean maximum temperatures are respectively about 66°F and 73°F. However in the south-west there is a prolonged growing period as the following table shows:-

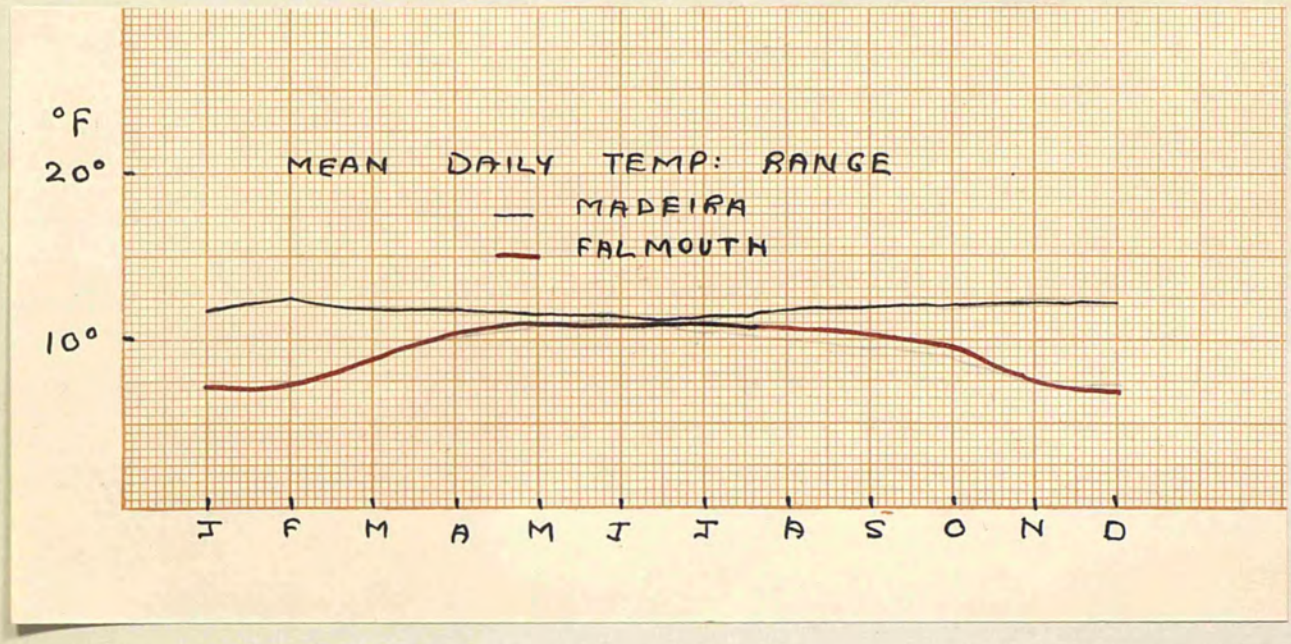


Illustration 13. Mean daily range at Falmouth.

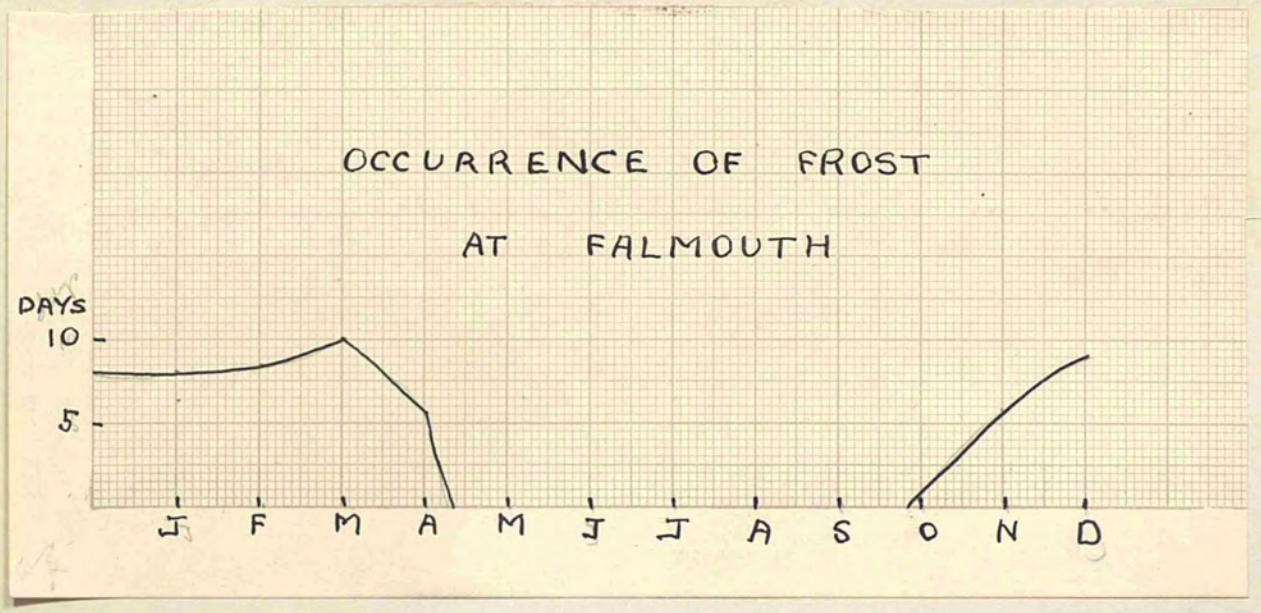


Illustration 14. Duration of Frost at Falmouth.

Table showing "day degrees" accumulated:-

	South-west.	South-east.
November.	128	117
December.	83	69
January.	77	58
February.	67	59

In the south-west 63 extra degrees are accumulated which amounts to prolonging the growing season by one month. Yet the summers are too cool and the south-east accumulates 205 day degrees more than the south-west in the critical months as follows:-

	South-west.	South-east.
March.	98	102
April.	215	228
May.	291	323
June.	420	447
July.	619	672
August.	483	524
September.	397	421
October.	303	316

Rainfall.

Although the mildness of temperatures is a feature it is the excessive heaviness of the rain which distinguishes the region. The rainfall element in climatic considerations is important for agriculture and often determines the type

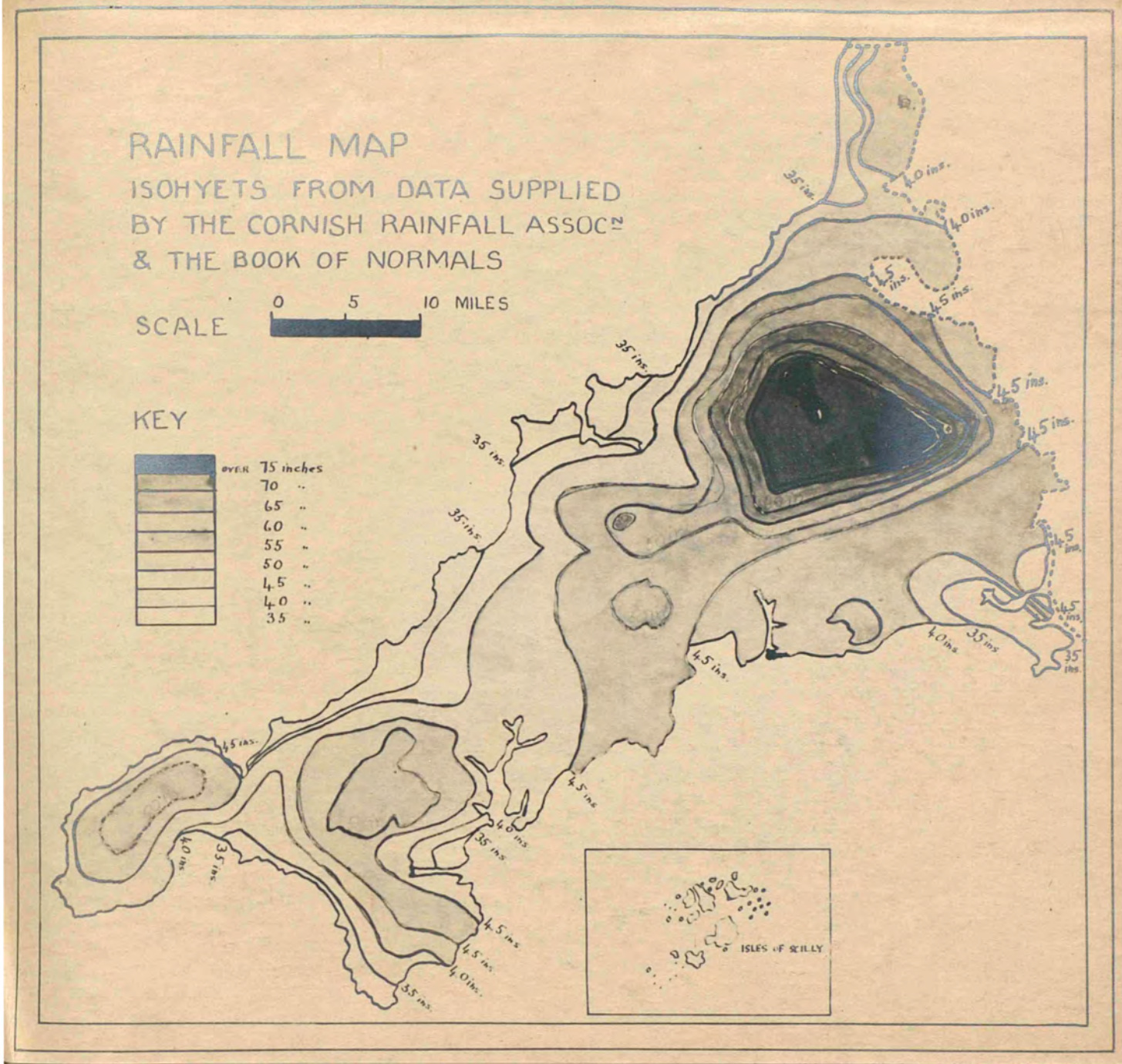


Plate 4. Average annual Rainfall.

of cultures. Here relief is the most potent factor since the peninsular nature gives a maximum influence to effects of relief. There are no gaps here as in Down Country when great local differences are thus produced but each heavy rain area is separate and isolated. The steepness of the slopes is not here so important as in some cases since the existence of several peneplains at different levels but well preserved on all sides results in a more or less uniform slope. It is interesting that the effects consequent on cooling are seen to occur just before the highest land is reached since there is a more or less gradual increase in distribution.

Early autumn and winter is the stormy period when up to 5 rain days in each month may be experienced whereas about 4 are usual in spring and autumn months and only about 3 during each of the summer months. There is some fluctuation from week to week especially in the stormy autumn period.

With regard to amounts received there may be as much as 5 inches in the winter period for each month, about 3 in September and March and only perhaps a total of 2 inches in May.

The average distribution map is based on a 35 year period or cycle for major stations and is thus far reliable; supplementary stations, however, are for less definite periods. The Cornish stations are neither frequent enough nor sufficiently well distributed to make the construction of such

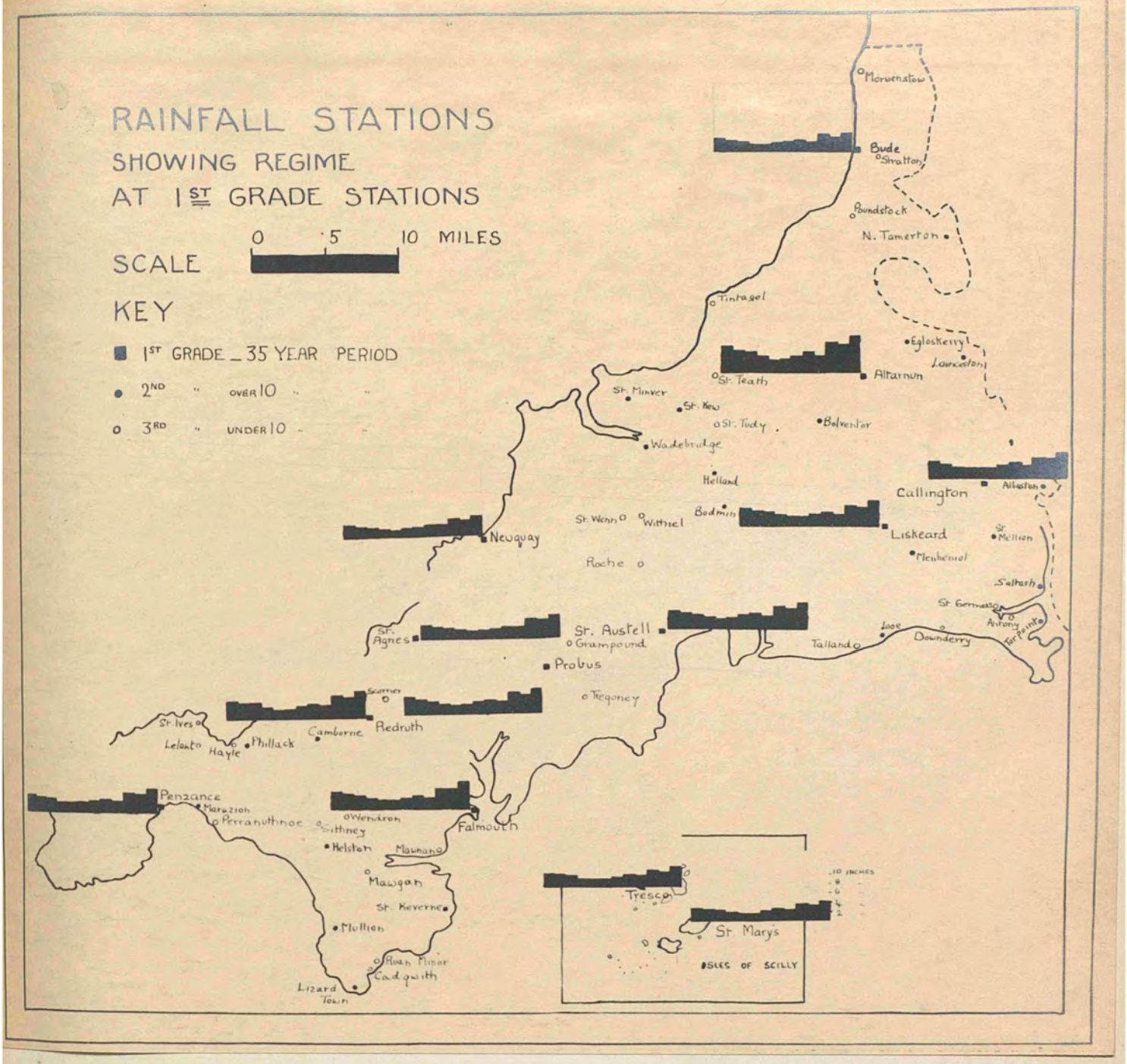
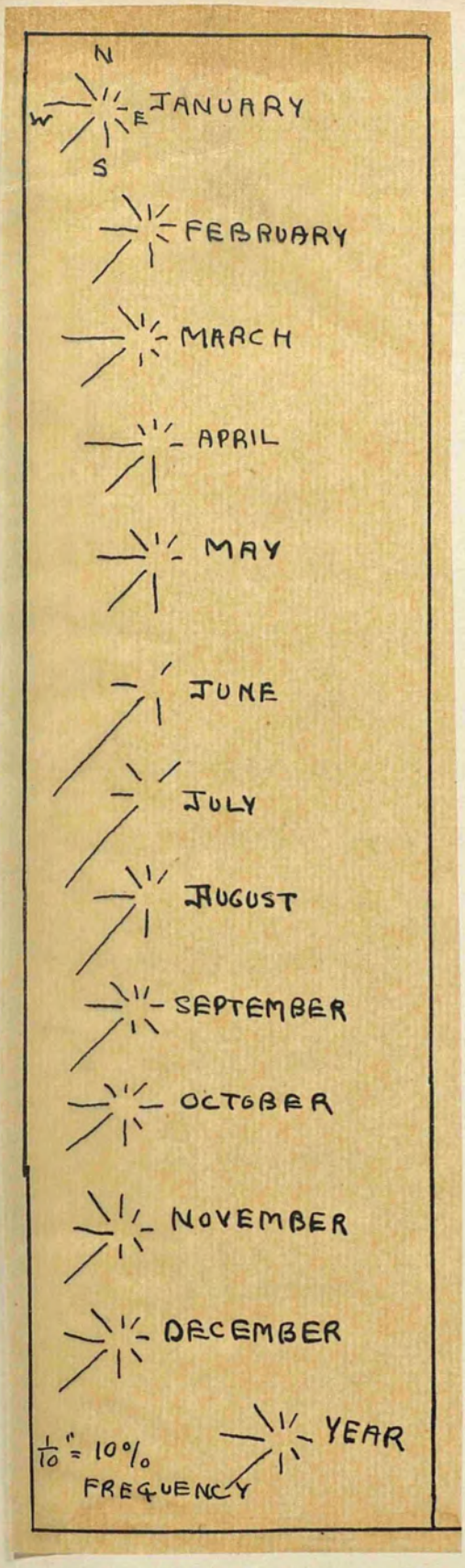


Plate 5. Regime at Chief Stations.

(a) Summer minimum.
(b) Peaks in October & December - drop in November.
(c) Effect of altitude - e.g. Altarnun.

a map easy or accurate. It is, therefore, only a tentative distribution since there is no station at all for the Penwith Moors and only very few which are badly placed for the Bodmin Moors. There are, incidentally, enough observation stations but it is the distribution which is bad. The coastal areas also suffer since there are few complete records, especially the north coast. Thus the valleys of the Tamar, Camel, and Fowey, have no lack of stations whereas complete gaps occur in between. It is interesting that records for the last 20 years give considerably higher figures and indicate a wetter period especially within the last decade. With regard to the average distribution, however, the rain areas stand out strongly in contrast to the lowland areas. The very highest value recorded is an average of 75 inches for the Bodmin Tors, Rough Tor culminating in Brown Willat a height of 1375 feet, Kilmar and Brown Gelly Tors at heights of 1296 feet and 1112 feet. A triangular area at a height of about 600-1000 feet has upwards of 55 inches of rain and a smaller area within this has a 70 inch average around the Tors. The gradation appears to be gradual up to about 60 inches and then a steeper gradient occurs. Land from 400-600 feet averages 50-55 inches as on the West Penwith Moors, Carn Menellis - the granite boss south of Camborne - and an extension of the Bodmin Moors across the watershed between the Camel and Fowey westward to St. Breock Downs and also Hensbarrow Downs. These areas are bordered by a



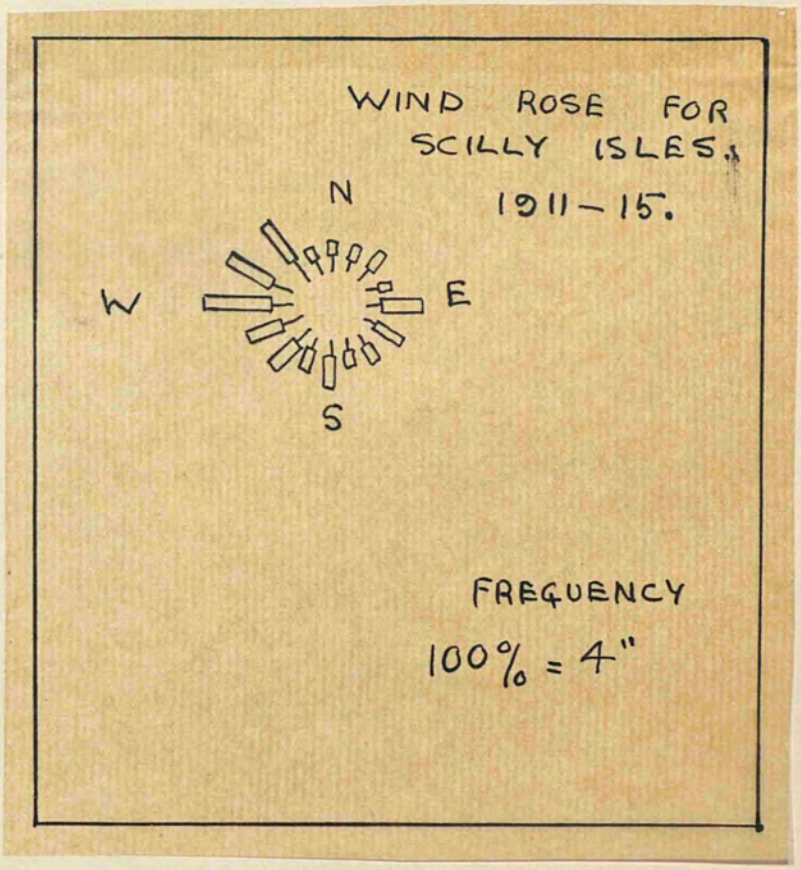


Illustration 15. Wind direction, from Weather of the British Coasts.

45-50 inch average which in the case of the westward extension from the Bodmin Moors forms a broad belt southward to the coast between the Fal and Fowey systems. A southerly extension also occurs in the Lizard peninsula where the agricultural district of St. Keverne is situated on higher ground. The only isolated patch is the hilly area in the neighbourhood of Looe. The 40-45 inch average includes most of the remaining districts of the peninsula except for coastal strips, a wedge in the "strait" between Mounts Bay and Hayle, another wedge near St. Agnes, and the south-eastern district. Thus are included the upper and middle Tamar, the Fal drainage, and belts around the higher areas as before; the other areas mentioned average 35-40 inches. Areas with 35 inches or less occur along the north coast as far as Padstow, where even the headlands receive little more. Nowhere on the south coast from Helford River to the extreme south-east is the 35 inch isohyet in evidence. This suggests that the wind direction has a strong southerly component since in such a long and narrow peninsula, provided a symmetrical relief, a due west wind would bring equal amounts to both northern and southern coasts. The isohyets of themselves give a correct general plan of the relief, the bends indicating the valleys as in the case of the Camel. The belt of heavier rain between the Fal and Fowey is perhaps due to the fact that the Fal affords

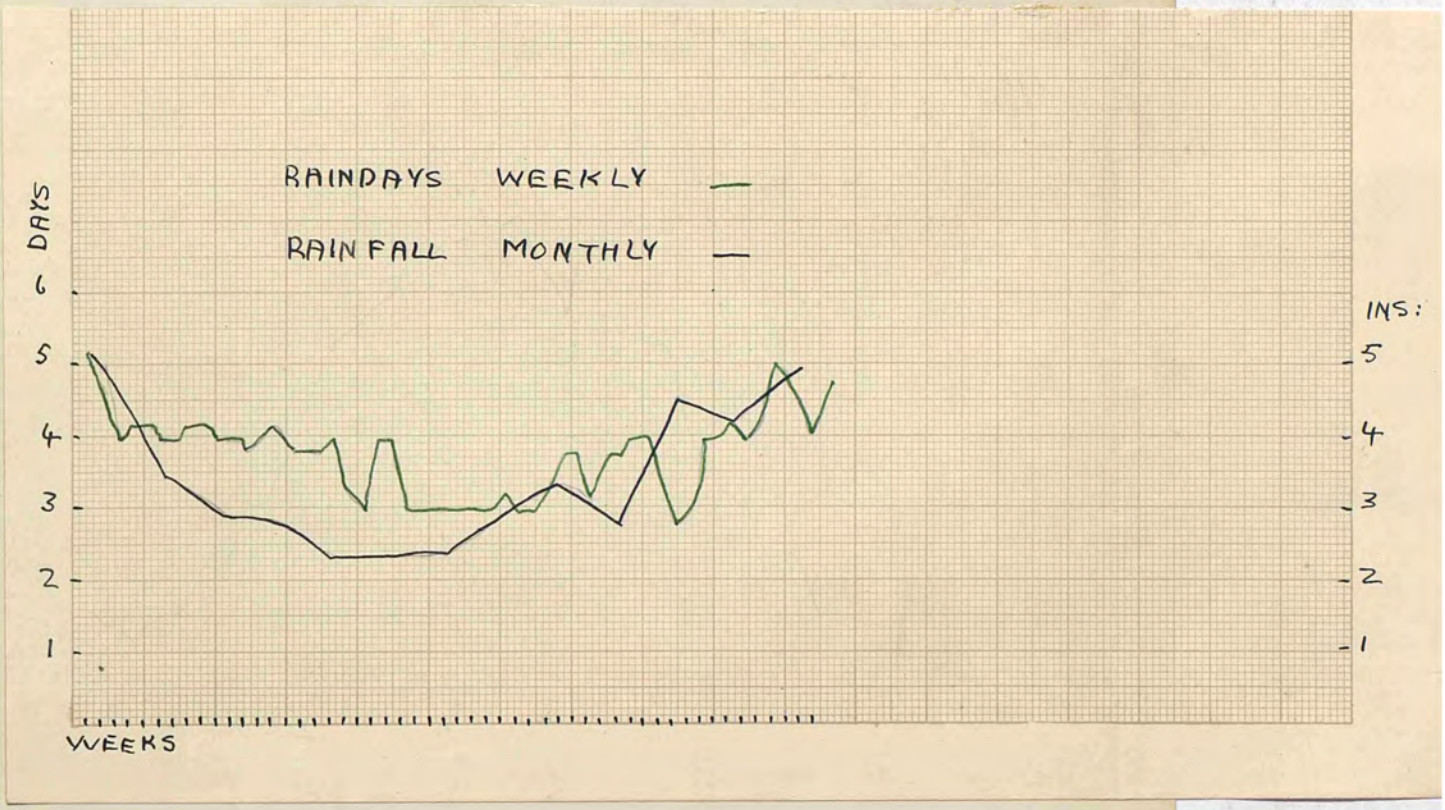


Illustration 16. Graph of average number of Rain Days.

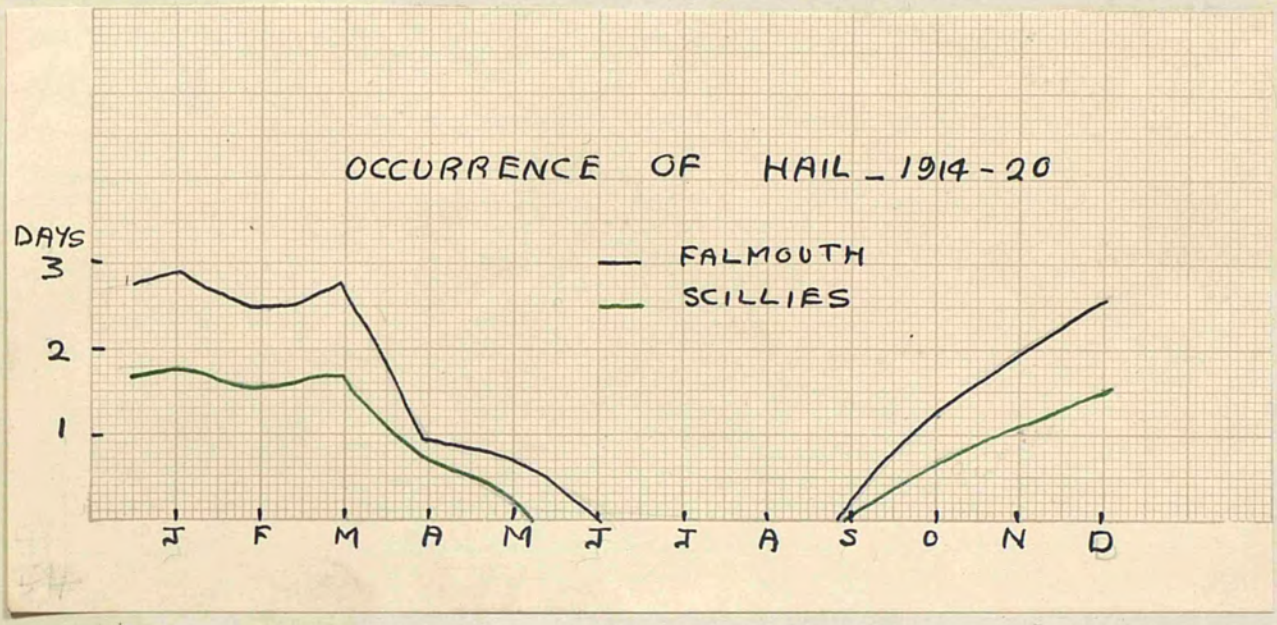


Illustration 17. Graph of the occurrence of Hail.

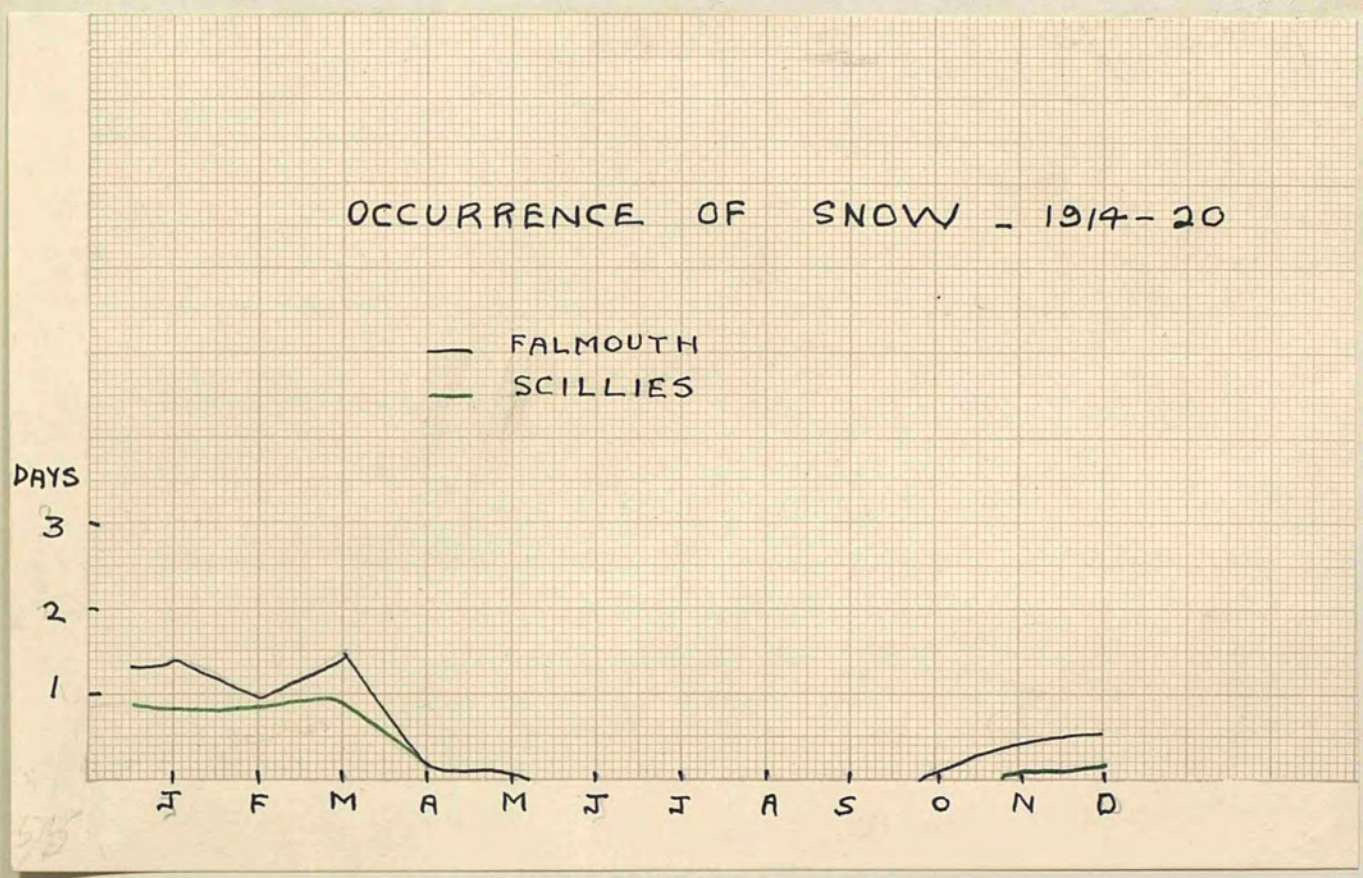


Illustration 18. Graph of the occurrence of Snow.

a greater penetration owing to its alignment with the wind direction. It is not a true funnel line on account of shape but may afford a greater means of penetration to a south-westerly wind. Effects of increased tendency to rain are noticed before the high moors are reached.

Precipitation.

It is the factor of precipitation which, much more than either sunshine or cloudiness, makes the region as distinct climatically as it is on grounds of structure. The high and uniform local temperatures result in very slight precipitation in the form of either hail or snow. The small amount of hail occurs in January, February, March, and perhaps June, but in no one month is there more than 3 days of hail at Falmouth or 2 days in the Scilly Isles. The June-September period is entirely free from hail. With regard to snowfall there is never more than 2 days at Falmouth or 1 day in the Scilly Isles which is usually sometime in March. The important fact of interest to agriculturalists, however, is that the period May-October is entirely free and also that in the peninsula snow never lies.

Relative humidity, cloudiness and sunshine.

The south-western peninsula in general is characterised by a relative humidity above the average, a greater cloudiness and lesser amount of sunshine than is normally experienced in the south of England. This applies with even greater force to the peninsula west of the Tamar boundary. Here in

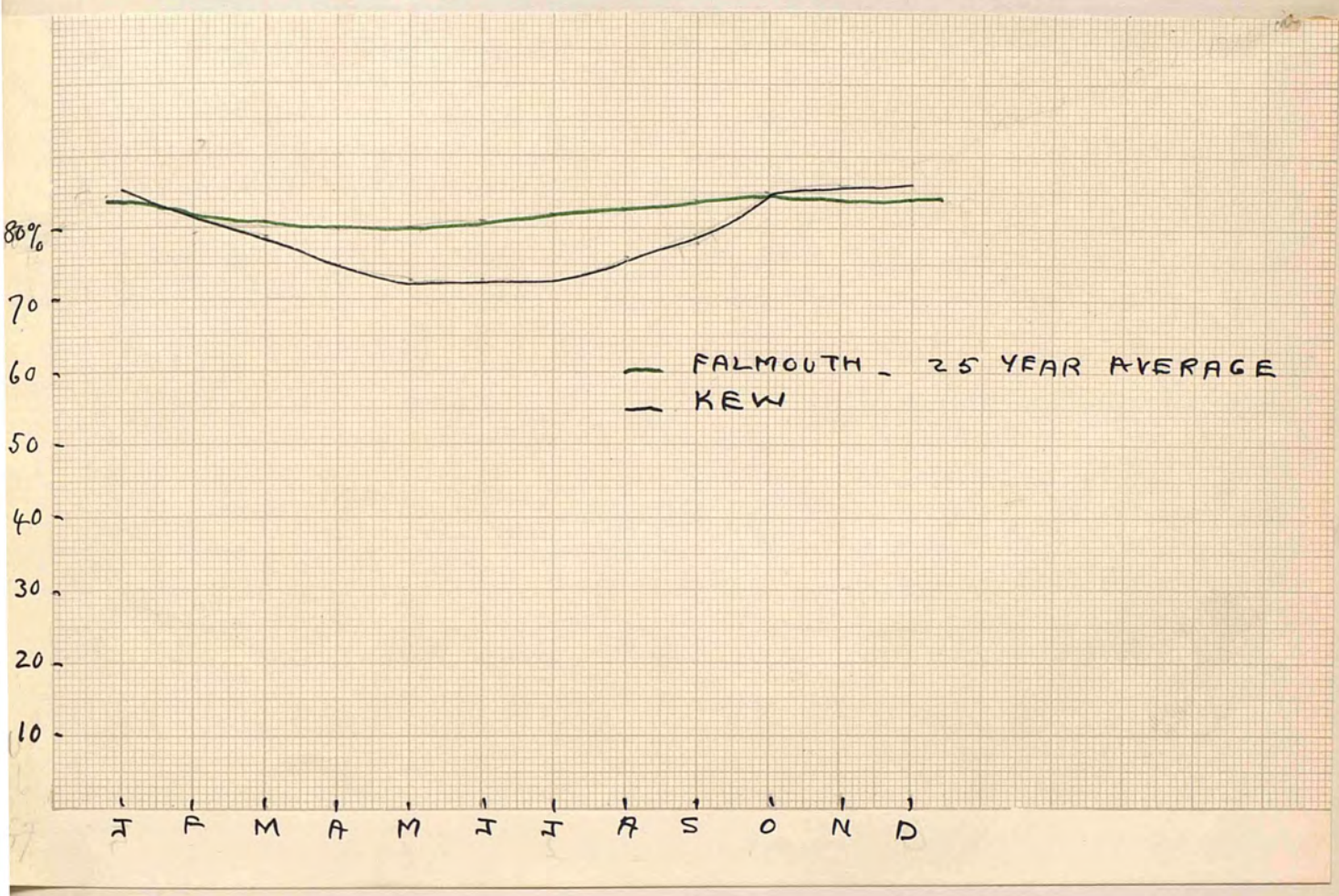


Illustration 19. Graph of relative Humidity.

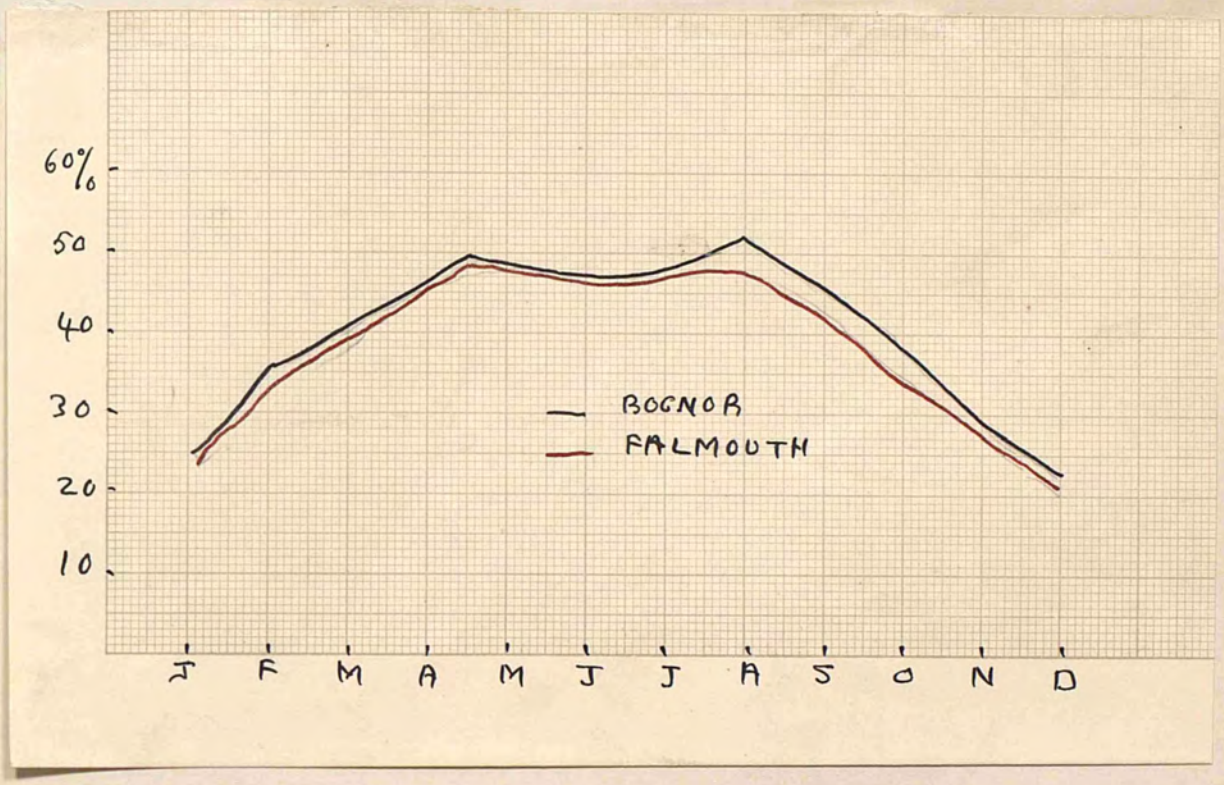


Illustration 20. Graph of Sunshine recorded Monthly.

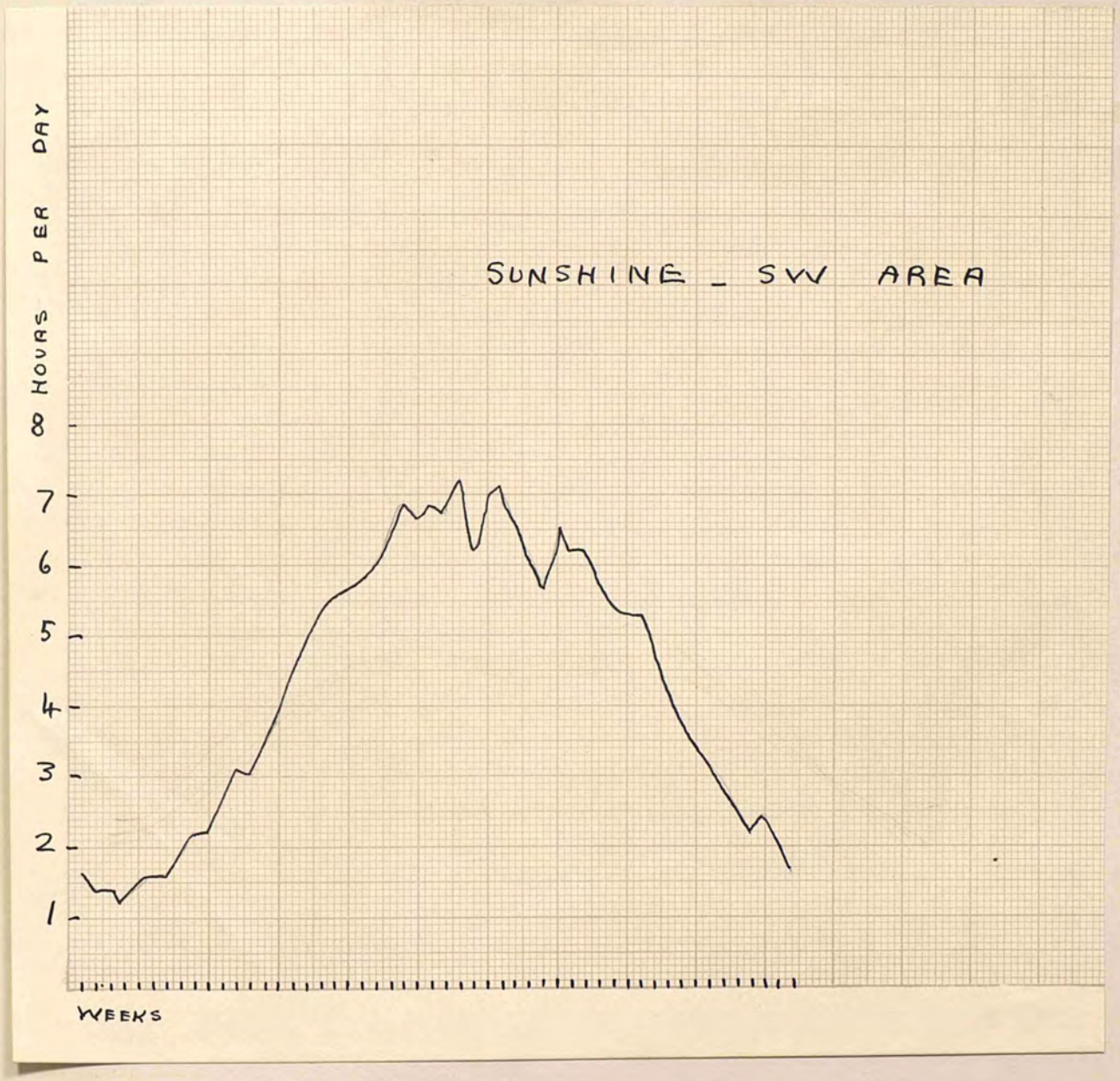


Illustration 21. Graph of Sunshine recorded Weekly.

the summer months the actual average amount of sunshine received is 7 hours per day as compared with an average of 1-2 hours per day in winter months and 3-6 in spring and autumn, which here are prolonged and, therefore, a greater amount of sunshine is recorded in the growing period which compensates for general cloudiness and a high relative humidity. Figures indicating relative Humidity are available only for Falmouth.

CHAPTER III. TYPICAL CORNISH SOILS.

Two characteristics of the soils of Cornwall are worth noting; firstly their great variety and secondly their analogy to the parent rock beneath them. The second fact is the more striking since a comparison and even a detailed study of the geological map reveals the fact that here is an area in which there is very little drift except for some recent deposits of blown sand and peat and alluvium along the valley lines. Consequently elsewhere there is a very close analogy between the pure geological map and a soil map. From the point of view of agriculture, however, the variety of soils is distinctly important. The character of these soils is peculiarly interesting since here are found at least four soil types which belong especially to Cornwall. These were classified in 1846 by Karkeek and form agriculturally the most interesting and important soils within the area. Of these the Serpentine soils are the most distinctive and peculiar since they occur on any comparable scale in no other dtsirict of England. The corresponding area in Devonshire is formed by the southern headlands of Bolt Head and Start Point which are of a much smaller scale. On the analysis of Prestwich in 1842 this rock is composed of 34.6% pure magnesium and the derived clays of 33%. Thus owing to its composition the soil is excessively harmful to all vegetation

since even in the case of a limestone the presence of magnesium or calcium makes a considerable difference to the vegetation which results. The magnesium earth is saturated with moisture which in the case of the Lizard area results in peat and bog land. Across the Channel in Brittany alone can the same desolation and barren waste be felt.

The Cornish Heath alone will grow on such magnesium soils. Therefore, the mapping of the magnesium areas of Cornwall, Brittany, and parts of France and Spain very closely coincides with the distribution of the Cornish Heath. Of all these areas a barren, flat, or very slightly undulating country is a feature supporting an exceedingly thin and poor soil. With regard to the origin of Serpentine it is known to be a decomposed, eruptive, rock which may have been formed from a gabbro, gneissic rocks, crystalline schists or olivine. It is greenish or deep red with a marble structure and when red the colour is due to the presence of oxide of iron. The hydrous silicate of magnesium is the harmful element. The rock is veined and these veins of soapstone, diabase, and diallage, are favourable to soil formation and vegetation and consequently account for the very striking changes in vegetation cover even in one and the same field.

The distribution of the granite soils is more general and, although granite soils occur elsewhere as in Devonshire, yet they are here so important that they must also be considered typical. The soils formed from the

Cornish granite are known locally as "growan" soils which are generally of a gravelly nature. The fertility of such soils varies very greatly since they are often rotted to a depth of 100 feet in the low lying areas whereas on the bleak uplands nothing will grow. Consequently barren and desolate moorlands and rich market garden areas are both found on the soils derived from the same parent rock. Such growan soils consist of quartz and felspar detritus and peaty mould such as is formed by decayed heather vegetation. The soils of the Land's End district also contain some potash and would, therefore, be especially valued if it were not for their bad site. The derived clay soils are both gritty in nature yet smooth when touched. The clayey nature is bad and the ruggedness and great elevation often act against cultivation. Often only the silica is left and the other constituents are dissolved out. In little elevated regions characterised by ineffective rainwash the granite is merely disintegrated and not dissolved the soil formed varying from a brown loam to a rough gravel. Thus aspect and exposure are vitally important, since on the high and bleak Bodmin Moors the productive power of the soil is completely nullified. Whilst a certain iron content is good, a great amount of silicate of alumina and boric acid are not, so that their presence corresponds to a lowered fertility in the St. Austell district. The area of greatest fertility and enjoying the highest state of cultivation is the district

west of Penzance including the Scilly Isles. Where, at such elevations as these, a stiff clay is washed down and collects in every hollow there all the essential materials are retained. This higly productive soil, a combination of peat and granite, is the basis of market gardening. It was here that in 1850 a Red Cornish Wheat was grown successfully, the soil producing 40 to 50 bushels per acre as compared with an average of about 33 for south-east England. Potatoes do equally well on such soils which are friable and easily tilled. Dry stone walls or "Cornish hedges" are a protection against loss by erosion and leaching. In great contrast, since of the same origin, are the soils of the typical granite bosses which with very few exceptions are fit only for poor moorland pasture. In small areas where washings occur, however, a better quality grass cover exists as in the Central Massif of France where cattle pasture is good.

A third peculiar rock is diorite which gives rise to a fertile soil in Meneage when it occurs even alongside the serpentine. It is in origin an igneous rock included among the greenstones but has a granite-like structure and may contain labradorite. Several varieties occur and may contain acids, quartzite dykes and sheets. Having a high lime content the soil is used as a dressing on the land where wheat and buckwheat can be grown as in Brittany. Various authorities

are agreed that these Lizard soils are fertile and this fertility is to a large extent due to the presence of labradorite in the original rock in which occur lime and no hornblende, the lime content being the determing factor. This type of soil weathers rapidly to a "marly" soil. On the authority of Prof. Johnstone a farmer takes 12 inches of such soil in order to cover an area twelve times as large with a cover 1 inch in thickness! Thus a fourth type of soil is found. The slatey soils are less peculiar and formed on a large scale elsewhere.

PART II.

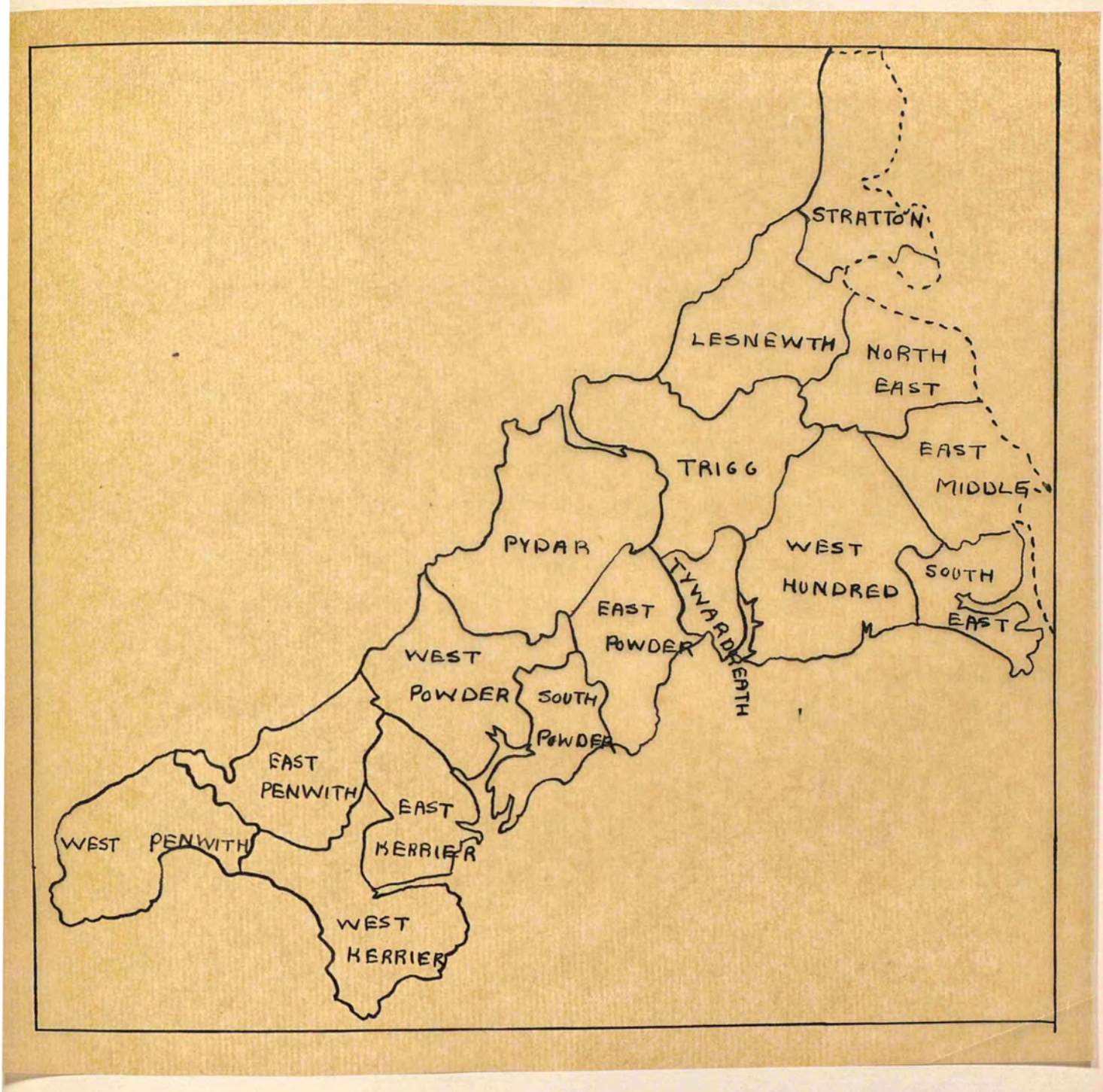


Illustration 22. Key Map to Petty Sessional Divisions.

N.B. Agricultural Statistics are plotted on this basis.

CHAPTER IV. AGRICULTURE.

Although agriculture may here be considered subordinate to industry since it is of later origin and is still practised on a small scale only, yet it is of vital importance and the predominant interest. Cornwall is essentially a county of smallholders working on an intensive scale since there is a preponderance of grassland. The clays, loams, and marls alone produce good agricultural soils. With regard to livestock, cattle, sheep, pigs and poultry are found. During the summer months cattle and sheep are depastured from the moors. Carew's account of early agriculture shows that little attention was given to it at that date. He says "in times past the Cornish people gave themselves principally to the seeking of tin and neglected husbandry, so as the neighbours of Devon and Somerset Shires hired their pastures at a rent and stored them with their own cattle". He also mentions that until the tin began to fail they imported corn very largely. The usual practice was a wheat crop followed by two crops of oats. This was repeated and then followed by clover and left fallow for perhaps seven years ! Two kinds of wheat are mentioned on the fertile soils - a French bearded variety and a knot wheat. He stresses the importance of barley and the fact that in west Cornwall it ripens in 8 weeks and yields 20 to 30

bushels per acre.Lysons also mentions mixed corn and the importance of oats and barley as at the present day. This is a survival of the primitive cereal culture. With regard to fruit growing Carew mentions small fruits, orchard pears, plums, and cherries as well as mulberries, walnuts, and vines. Lysons mentions the orchards of the Stratton and Calstock districts. Among the root crops potatoes have always been important and are mentioned by Borlase near Penzance. Weekly markets and fairs took place then as now but the south-west has always lacked a market, except at Plymouth.

With regard to modern devlopments an Agricultural College for the south-west is situated at Newton Abbot in Devon and there are experimental plots in Cornwall where liming is practised.

Specialisation in market gardening and horticulture are a feature both on the mainland on the shores of Mounts Bay, and in the Scilly Isles. Tresco is the home of the narcissus which was first despatched to London in 1870 and later became remunerative. Flowers are about one month earlier here than in the Channel Islands or in Holland. Since 1900 the export of early flower produce has grown as follows:-

1901	.....	650 tons.
1902	.....	750 "
1903	.....	700 "
1904	.....	800 "
1905	.....	700 "

No recent figures are available.

Cultivation began in 1885 on the mainland in Ludgvan parish and has since been extended. Gulval is now the centre. Seaweed and shell sand are used as fertilisers in both districts. In the islands hedges composed of veronica or privet are a protection against the south-west gales. The harvest on the mainland is about 10 days later. It is of interest that Cornish bulbs are now exported to Holland. Scientific methods are being adopted and diseases investigated. The skill and observation needed appear to suit the Cornish character. The market demands earliness, attractiveness, and quality. The salient points regarding this intensive culture are uniformity, a constant even growth, and intercropping. This last point makes it necessary to know every strain and type, the time needed to mature, the best time of planting and in what soil. Outdoor cultivation begins in the islands in January and continues until May. Lincolnshire bulbs are later. Cultivation is now extending along the Tamar valley. The land is deeply ploughed before planting and bulbs are usually preceded by potatoes. The bulbs are first treated when dormant to prevent eelworm

disease since there is no remedy for this in the ground. They are slowly cooled and dried off rapidly. "Grooking" is practised in the islands by which process beds are covered with soil in July which is drawn off again in autumn to ensure the right depth of the bulb. The early flowers are all gathered in bud.

In recent years early potatoes have received more attention in various districts. The development in the west is shown by the following figures:-

1901	.....	4,600 tons.
1902	.....	6,100 "
1903	.....	6,300 "
1904	.....	5,200 "

Potatoes are followed by broccoli in the Penzance district which in 1905 amounted to 19,100 tons. Asparagus and tomatoes are also grown.

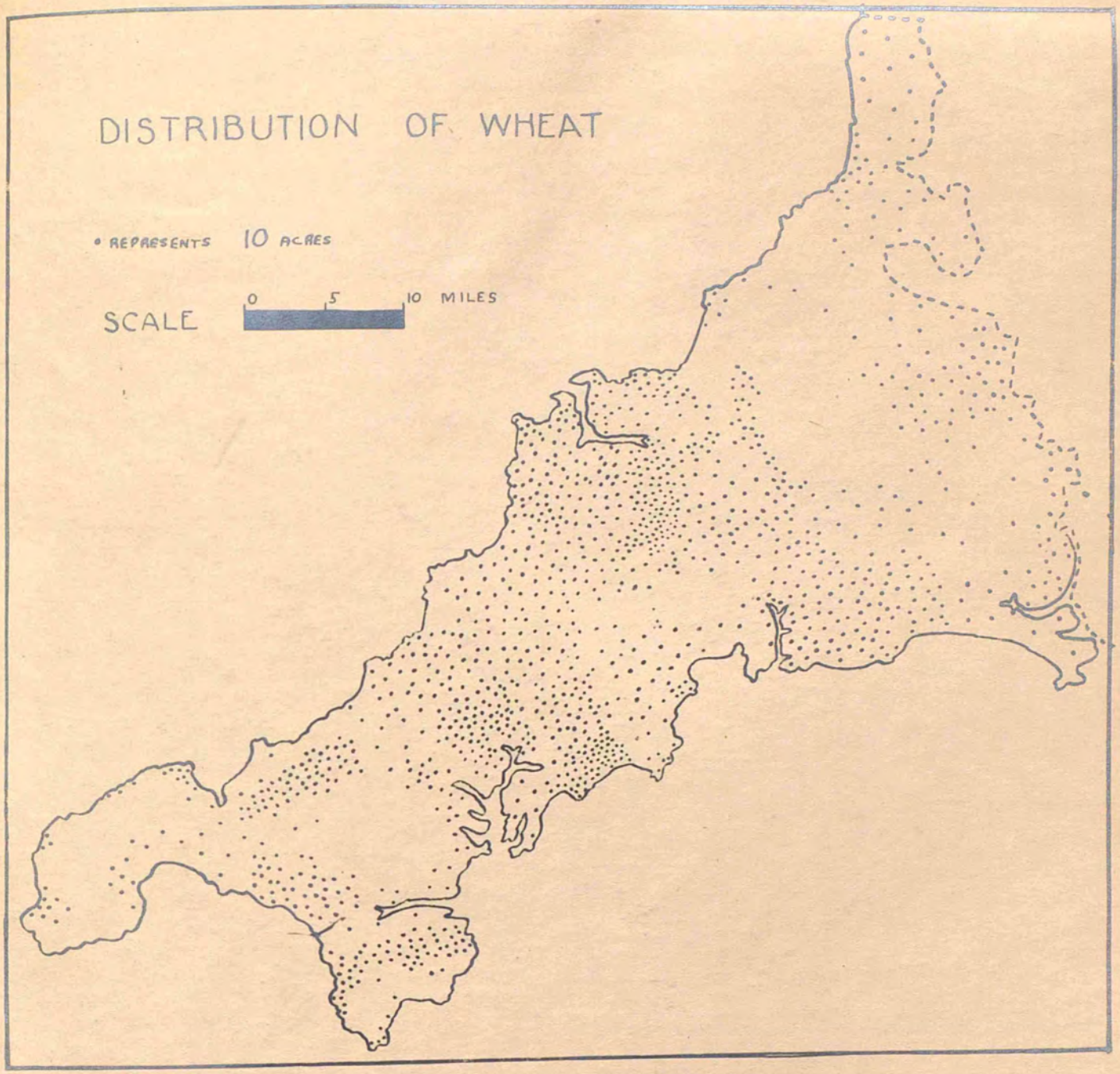


Plate 6. Distribution of Wheat.

(a) Cereals.

Wheat.

A consideration of the wheat distribution map with regard to physiohraphic and climatic conditions and to a lesser extent with regard to economic factors shows very clearly the degree of control exerted by each such factor. Taking first the physiographic influence upon the distribution the following deductions can be made. In every case in the regions of high moorland there is a sparse distribution and in some cases none at all. These are granite areas but it is only where granite has decomposed at low levels that it is valued as an agricultural asset; elsewhere bleak and barren moorlands only are seen. Greatly concentrated distributions occur at the other end of the scale as in the Pydar division. This is rather remarkable since in each map the closest spread is noticed here partly on account of the greater width attained and the lack of interruption of the lowland by the presence of a granite boss as so often occurs in other districts. There is also here no predominant mining interest. Concentration is again noticed on the rich diorite soils of the Camborne area and the very fertile decomposed granitic soils of the south-west. The granite gneisses and mica and hornblende schists also support a denser grouping as at Goonhilly Downs and Ruan Major in the Lizard peninsula, the south-western tip of the Lizard and the Mullion and St. Keverne areas. Intermediate

between the sparse and denser groupings comes a more uniform and even spread of moderate density which is found on the slates and grits of the lower and middle levels with a rather greater density on the lower Devonian slates and grits. In most cases the valley lands are the areas devoted to other crops especially small scale market gardening and orchard fruits, although some wheat is grown. The Lizard peninsula shows the control of geological formation upon the crops of the area since in the same field it is remarkable to see the difference in the vegetation and crops and the degree of this control is nowhere better seen than at Ruan Minor. The somewhat surprisingly sparse distributions of the south-east and middle divisions are perhaps due in some measure to their great value as market garden and fruit areas. At the very bottom of the scale as regards agricultural value comes the barren and useless serpentine rock of the Lizard which literally supports nothing but the Cornish Heath which grows on this, and this only, as in Brittany owing to the excess of magnesium in the soil.

Thus physiographic influences alone are apparent in the distribution which is affected primarily by the major controls of highland and lowland and secondarily but as regards detail even more important - by the geology itself since in the Cornish peninsula solid geology and soils are synonymous in the absence of drift as such. The exceptions to this statement are the relatively small and unimportant areas

of recent alluvium, blown sand and peat.

Of the climatic factors rainfall especially exerts a control on the distribution but works with the relief since in this narrow sea-girt peninsula it is the major factor. The highlands with upwards of 50 inches annually are of little importance in this connection as is also true of lowlying areas with under 35 inches owing to the nature of the soils. It has been said very truly in this respect that had Cornwall a similar rainfall to that of south-east England a very large proportion would be arid waste. The isohyet of 45 inches annual rainfall seems to be the deciding factor since districts with a 40-45 inch rainfall are characterised by a moderate and uniform spread. The remarkably uniform and mild temperatures of the whole region exert a slighter influence since there is scarcely any variation from district to district. The question of day degrees accumulated here is interesting. As regards exposures there is very little difference between conditions on northern and southern coasts since the peninsular nature allows of the full effect and penetration of wind force.

The agricultural year of the peninsula is characterised by the early spring, mild winters, late autumn and longer warm period in the summer months as shown by the graphs. Agriculture is, therefore, favoured in every sense since the absence of severe frosts and long frostless period accompanied by an extremely light and rapidly melting

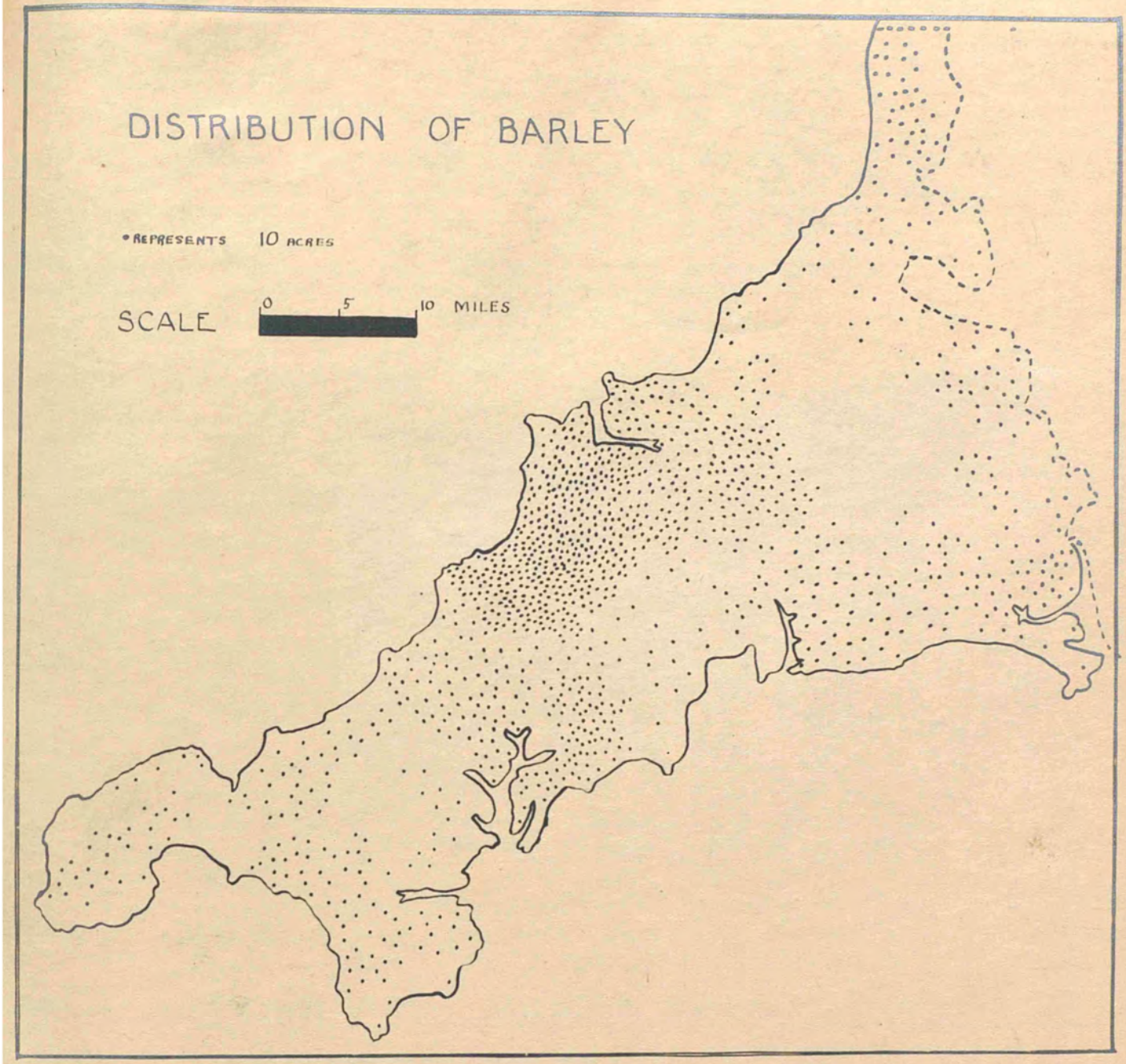


Plate 7. Distribution of Barley.

snowfall are too well known to need particular stress. Sunshine and relative humidity figures compare favourably with other districts. The drier, sunnier, and less cloudy period coincides with the harvest and is, therefore, a natural asset in addition. Especially in the south-west of England increased cloudiness and very heavy rains at time of harvest would be disastrous since the average is on the wet side for wheat. The dominant economic control is the distribution of local markets since the wheat is for home use and with this are linked the questions of population and existing transport conditions. These are not of very marked influence except perhaps in the case of Truro and some mining centres such as Camborne or St. Austell where a slightly greater concentration is found.

Barley.

The map which indicates the distribution of barley forms a contrast to the wheat distribution map in that it shows clearly a more even general distribution. There are no specialised areas as is the case with wheat which shows a denser distribution on the richer soils. In general within this region barley grows well on the poorer, upland soils which have consequently a heavier rainfall and cooler temperatures. Oats, however, grows still higher so that barley may be considered intermediate between wheat and oats, perhaps more nearly allied to the conditions required for and the general distribution of oats. With regard to details

of distribution the special barley soils of the region are found on the slates and grits over which a more or less uniform soil has formed. This results in a uniform and fairly dense distribution and does not show a more marked concentration in the case of the Lower Devonian as does the wheat distribution. The diorites also are reserved for wheat since barley does well on the lighter, poorer, soils. A good barley soil consists of about 10% coarse sand and less than 16% clay. Therefore, the soils formed by the slates and grits are preferred to the pure granite soils.

Consequently on the high, bleak granite areas there is no barley but a sparse distribution on the lower moorlands. The valley alluviums and alluvial patches are also devoid of any considerable barley distribution since here are the orchard and fruit lands combined with market-garden areas and other specialised but small-scale undertakings.

The northern half of the Lizard peninsula and the damp and bleak moors of West Penwith allow of the cultivation of barley but very little else will grow. Of the two areas the Lizard is the best in places since on more fertile patches quite good barley fields are seen. As in most of the crop distribution maps there is a much greater concentration in the Pydar district where is a greater acreage under crops, no special grazing interests, little fishing, and no pull towards mining centres as is the case in central and western districts.

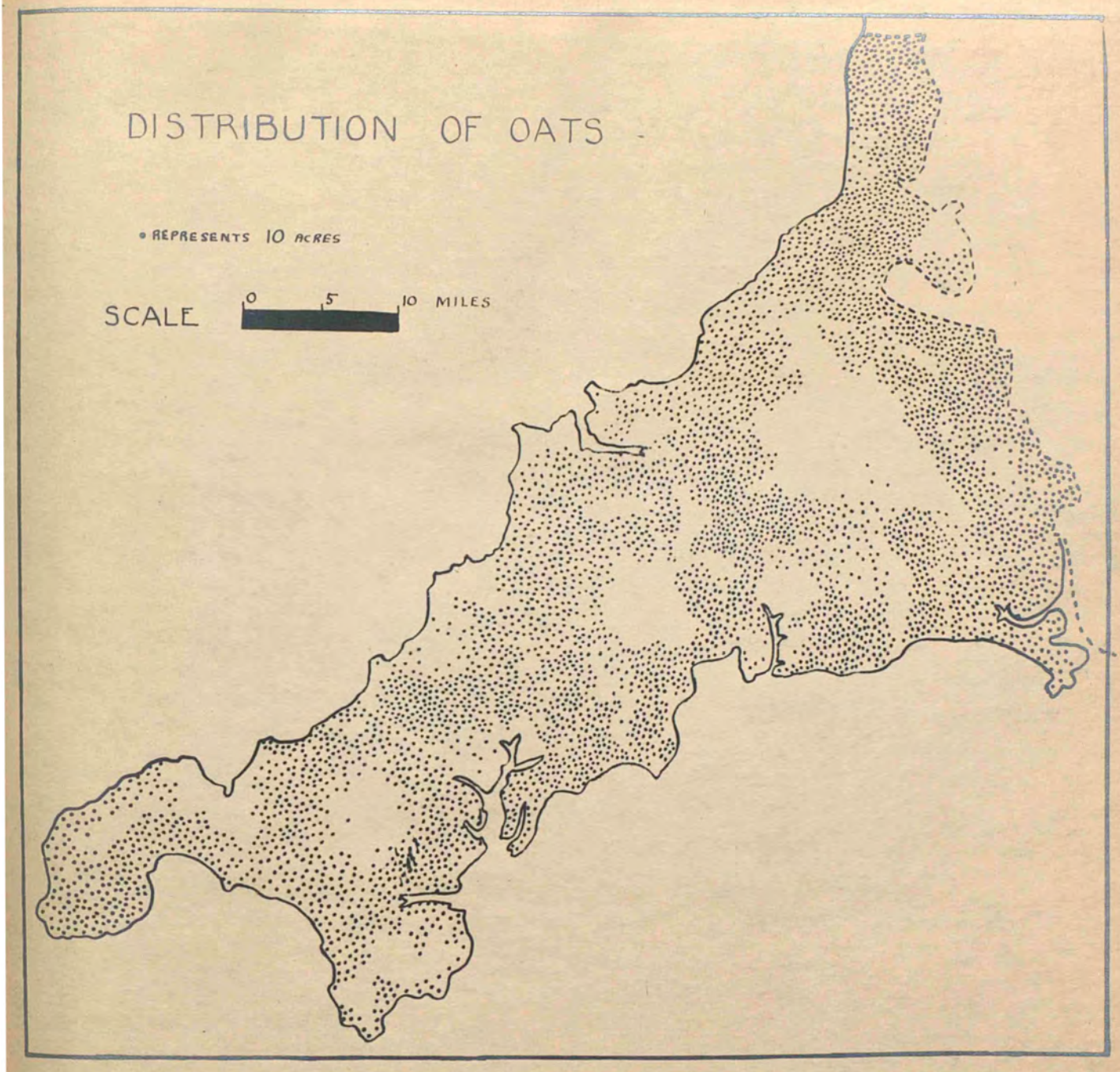


Plate 8. Distribution of Oats.

Photograph 12. Field of Oats near Land's End.

As regards rainfall the barley districts range from those having 30-50 inches and there is little over 60 inches but in some cases up to 65 inches will support barley although generally the heavier rainfall is better for the growth of oats. Only on the moorland edges as north-east of the Pydar district does the cultivation of barley coincide with the heavier rainfall areas.

The south-eastern lowland will support barley with a rainfall of 30 inches and under.

Oats.

A still more striking contrast is shown by the oats distribution map which is the densest of the three cereal maps, and shows a uniformly dense distribution. There is a small amount of rye and mixed corn grown including buckwheat as in Brittany, but in no case does the density make a distribution map worth while. The damp south-west is the most favourable district. Oats appears fundamentally to be the typical Cornish cereal since it grows well on the poorest, wettest, and most exposed areas especially on granite moorlands as on the damp exposed moors of West Penwith, where many farms grow both oats and barley. Concentration is again noticed in the Pydar district. As in parts of the Scottish Highlands and in Ireland it seems from the distribution map that oats would and does grow almost anywhere in such wet districts.

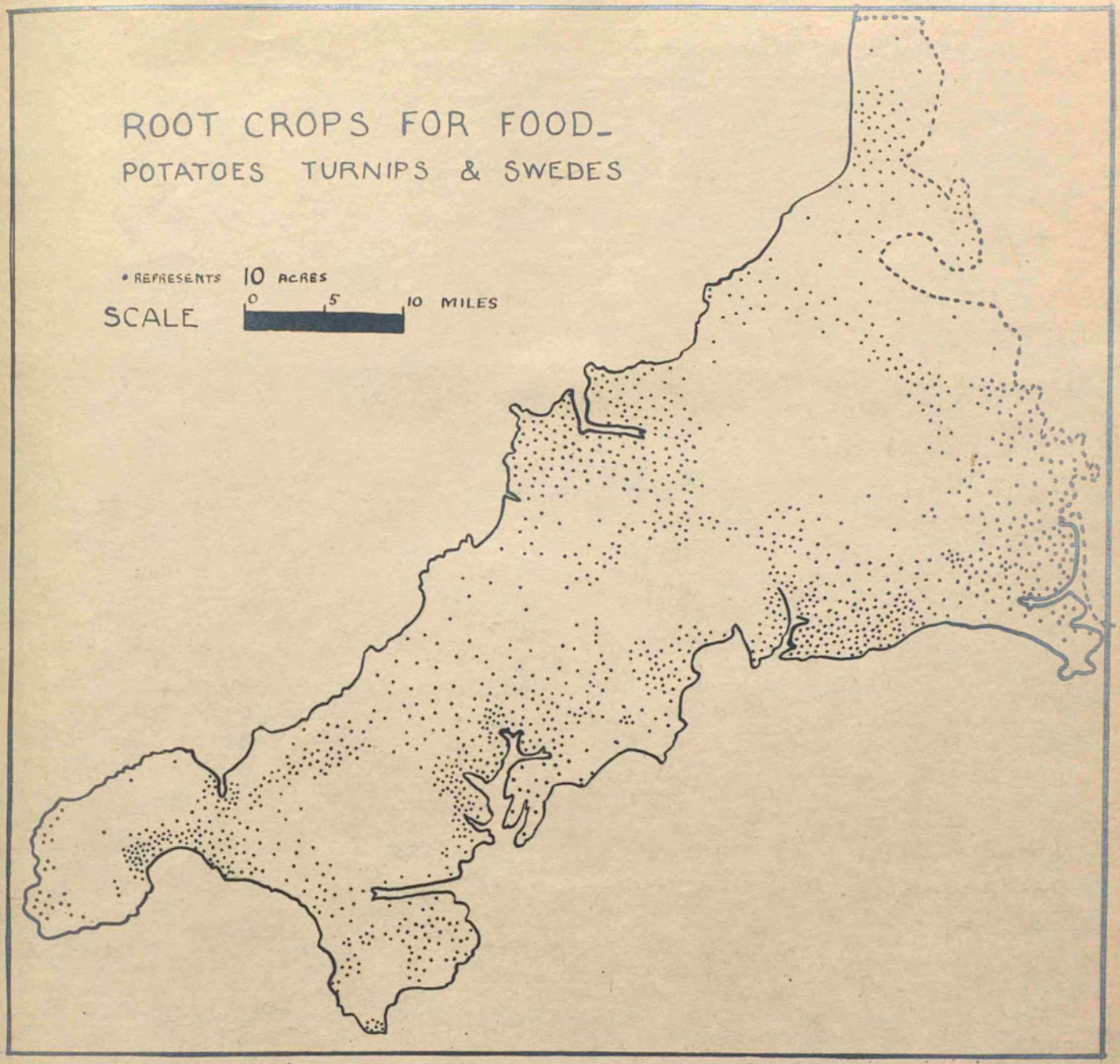


Plate 9. Distribution of Root Crops - Food.

The greatest concentration is perhaps between the isohyets of 45 and 50 inches, but oats will grow better at higher elevations than barley and especially on granite soils; barley will not grow on a clayey soil and, therefore, as far as possible avoids the pure granite areas.

(b) Root Crops.

Root crops mainly for food - potatoes, turnips and swedes.

The distribution map showing root crops mainly for food includes chiefly potatoes, turnips and swedes. Some of the latter two roots, however, are also used for fodder.

Potato areas are extremely localised and occur where light sandy and loamy soils are found.

In general the map shows a much more local distribution and varies from district to district. There is almost complete absence of these crops on the pure granite soils and a greater concentration in the south than the north. Except in the south-east the rainfall in these districts is everywhere over 40 inches. With regard to special areas there is a greater concentration round Camborne, Falmouth and Truro. The St. Keverne and Helston areas are also geavily cropped. The Mounts Bay district is especially productive as regards market garden products. The south-east is a market garden and fruit area to a large extent. In this one instance there is no great density in the Pydar district. As regards soils the better loamy soils are most productive and cultivation is intensive

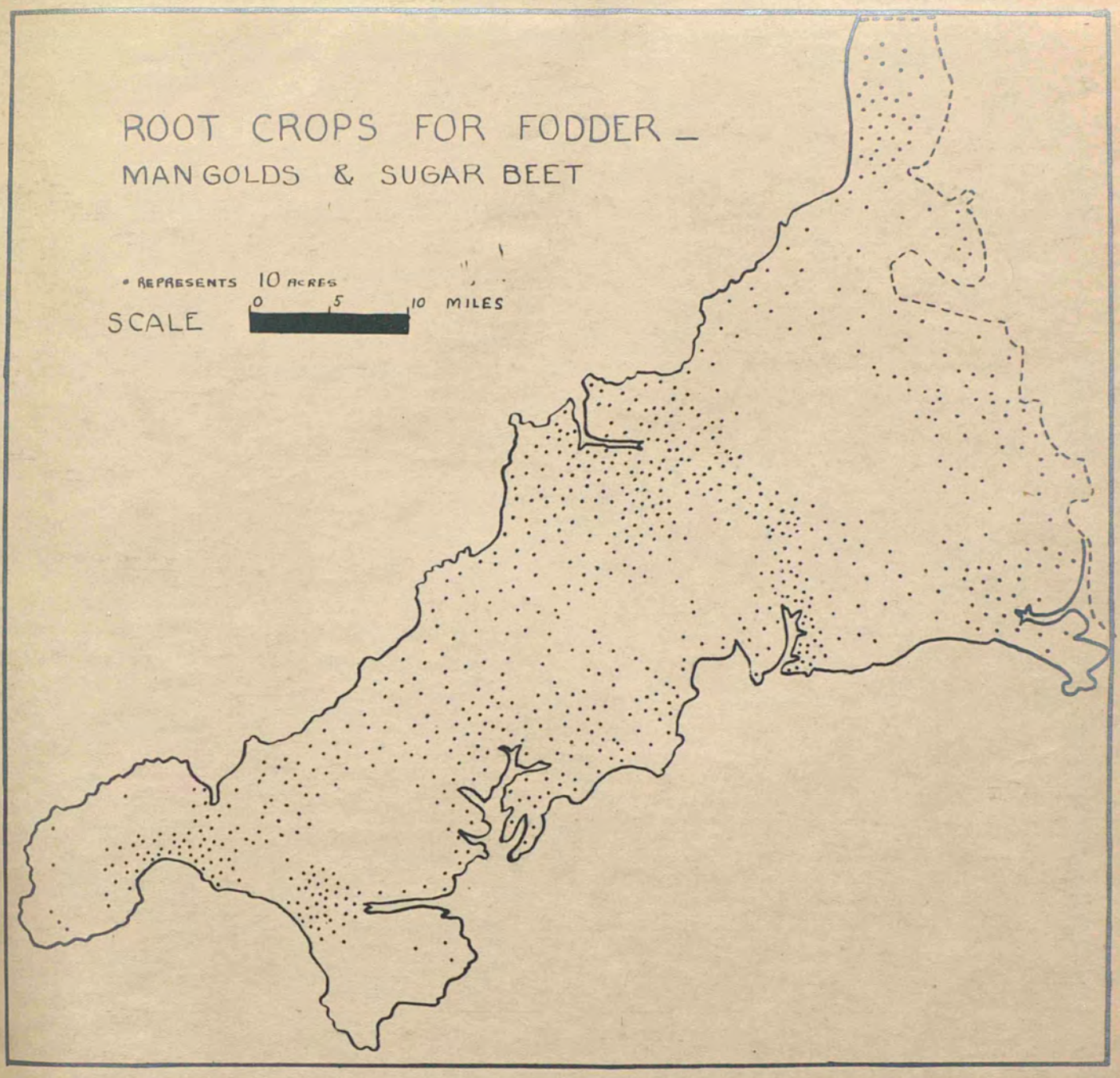


Plate 10. Distribution of Root Crops - Fodder.

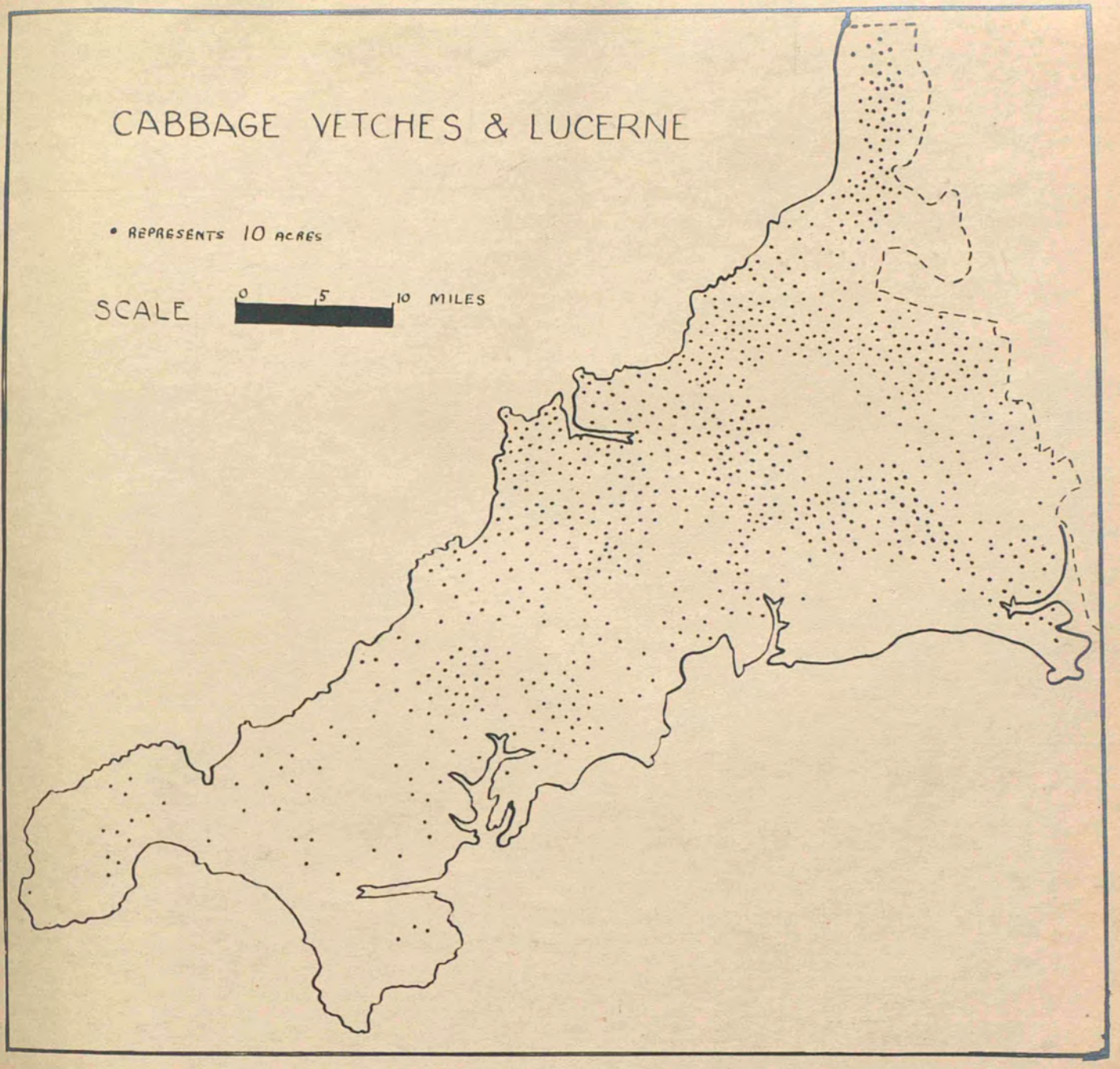


Plate 11. Distribution of Cabbage, Vetches, Lucerne.

rather than extensive so that these only are used. Catch cropping is a feature and in the Mounts Bay area early potatoes are followed immediately by broccoli. Catch crops are quickly growing crops which can be grown successfully where the season is prolonged and the harvest early as in the south-west of England. The potatoes are very early in ripening. Both crops have been taken off the same land for at least 60 years.

Root crops mainly for fodder. - mangolds and sugar beet.

In general these roots are not so localised in distribution which is much more uniform throughout the area. The slate soils seem the best and as before over 40 inches of rain is received. There is no marked concentration in the south-east area since these crops are grown where mixed farming conditions rather than specialised market gardening occur. Neither the richer soils nor the wetter areas are reserved.

(c) Green fodder crops.

The distribution map of green fodder crops forms a most marked contrast. The richer and wetter districts are characterised by a denser spread since these crops are largely shallow rooted. The south-east predominates especially as regards cabbage. Except for market garden areas round Truro and in Pydar there is little further west. East of the Camel-Fowey divide, in general, cropping is uniformly dense especiall

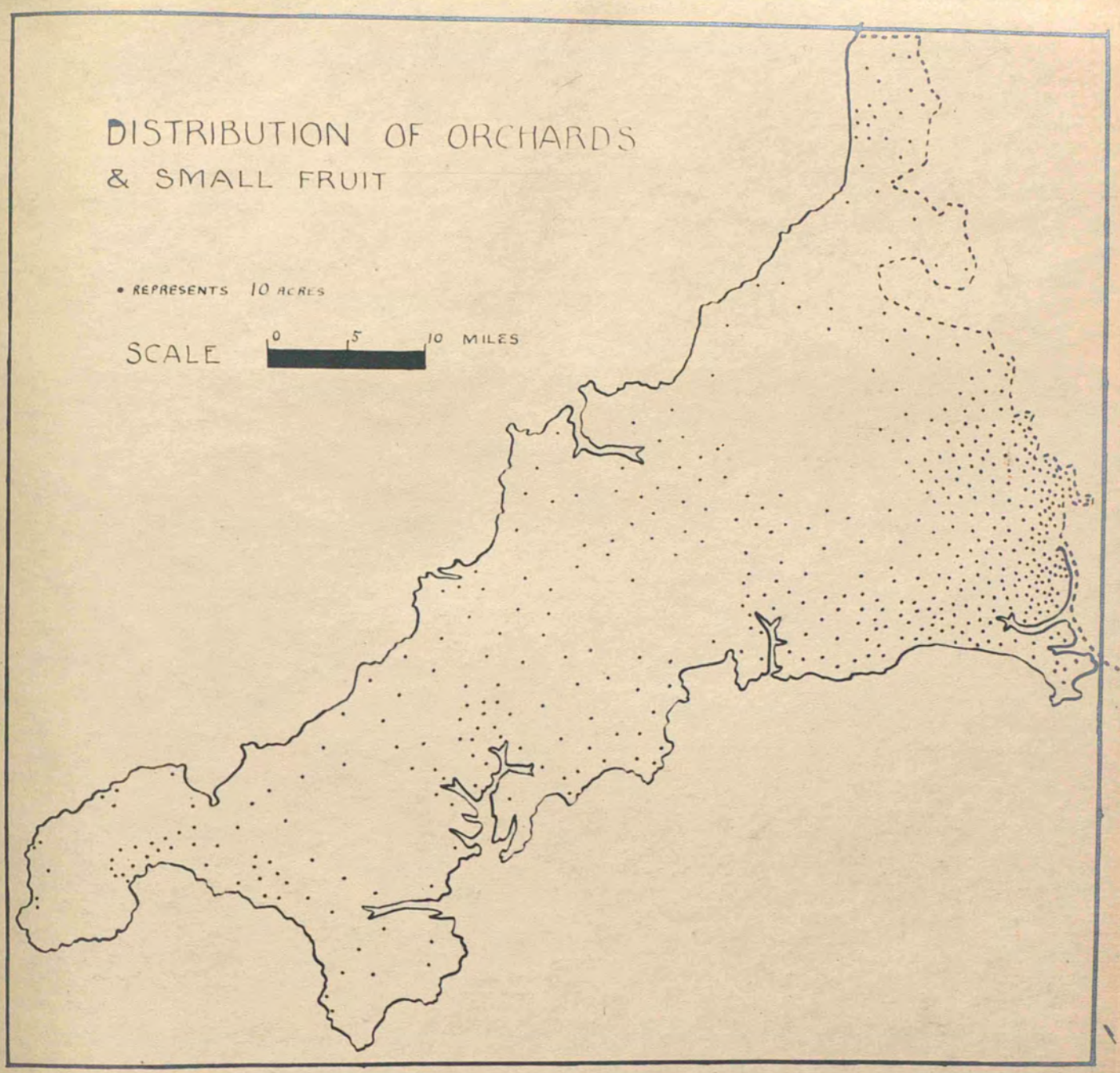


Plate 12. Distribution of Orchards and Small Fruit.

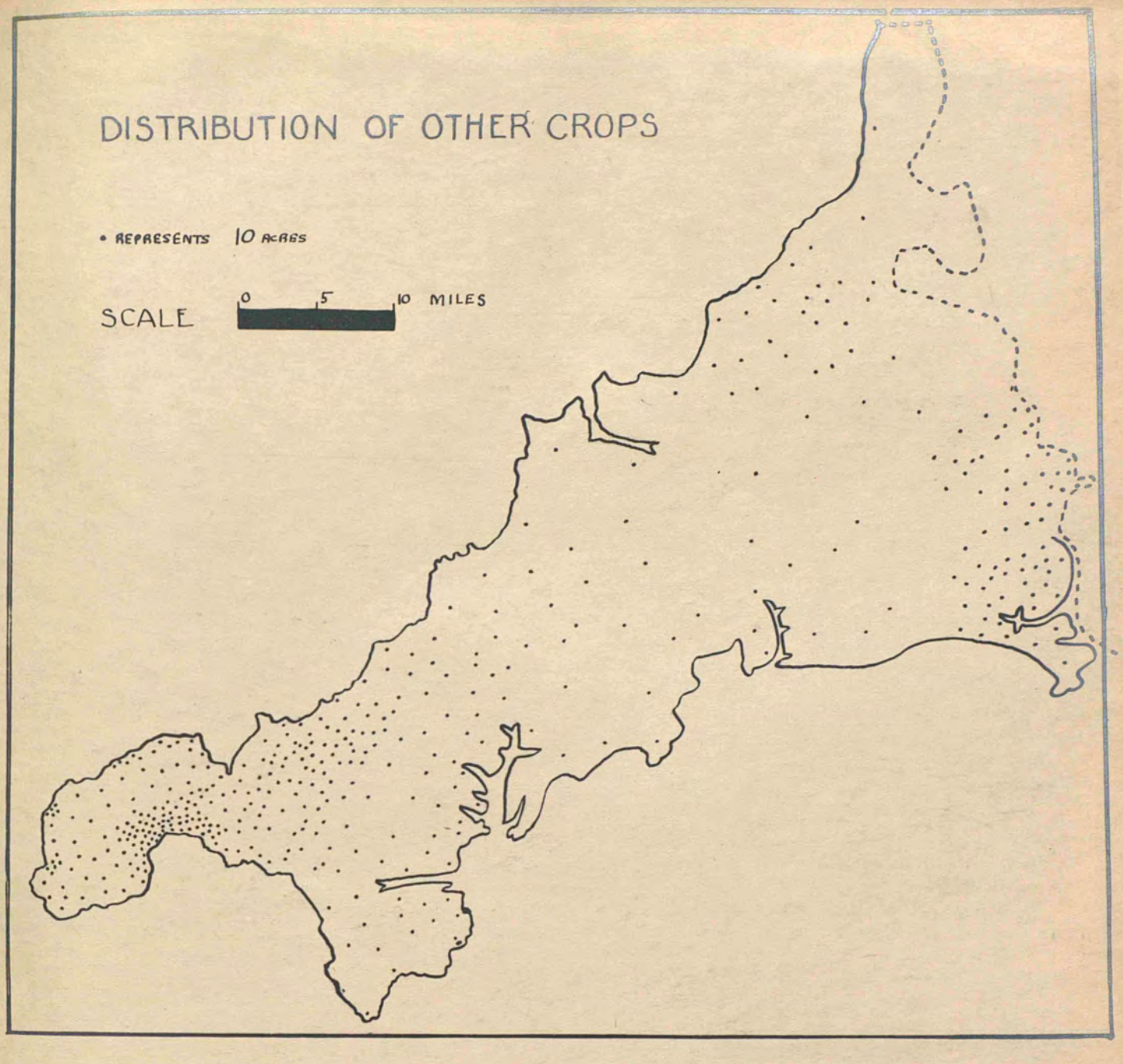


Plate 13. Distribution of Other Crops.

(a) Concentration in Mount's Bay and south-east Districts - market gardening.

(b) Very sparse distribution otherwise.

on the heavier rain areas and in the Tamar Valley. The richer decomposed granite soils appear to be the best and being generally high areas these receive an abundant rainfall.

(d) Orchard and small fruits.

Cornwall is not an orchard County and apples especially do badly owing to the presence of clay. Small fruits, therefore, predominate. Orchards need a rich loam; clay soils cause slow and poor growth of apples which are liable to canker. Wood growth develops in the west at the expense of fruit and, therefore, more pruning is necessary than in Kent where fruit ripens earlier and better. The lighter soils are good for raspberries and currants. A southern aspect and good drainage are essential. Therefore, as is shown by the distribution map the following are the chief fruit areas - Truro and Penzance market garden areas, the Fowey and Tamar Valleys, and to some extent in the south-east. Elsewhere fruit growing is not developed. The north coast areas do not support any fruit growth owing to unfavourable exposure. The valleys are sought both on account of soils and shelter from prevailing winds since the peninsula is windswept and bleak.

Arable land.

It is interesting that in many districts over 50% of the cultivated area is arable land since the proportion of permanent pasture is low. The available land is needed for crops and in the extreme south-west the percentage is as high as 75.

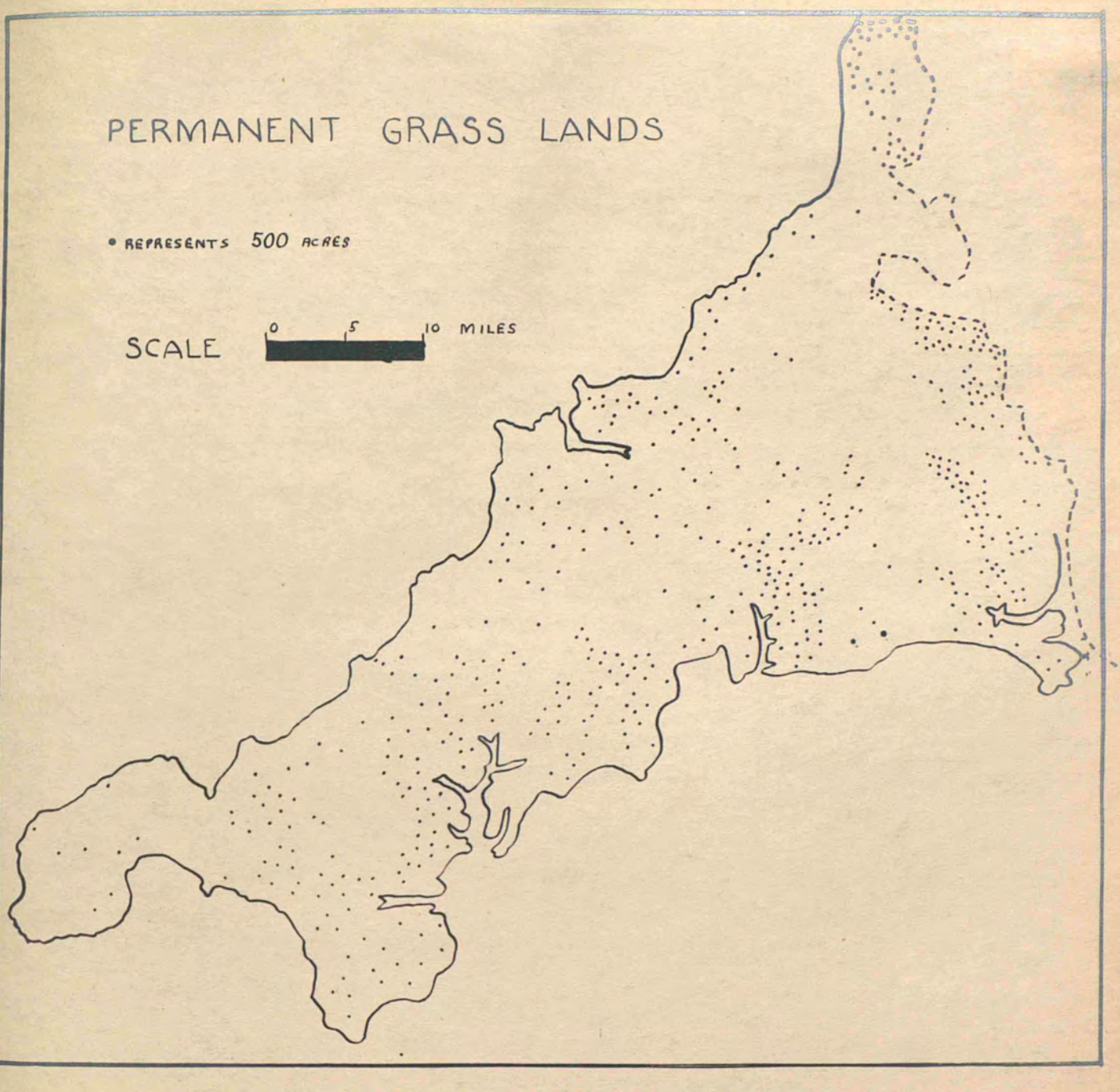


Plate 14. Distribution of Permanent Grassland.

Permanent grasslands.

On the map showing distribution of grasslands are included the acreage under grass for hay and also that which is not for hay. A certain amount of grass grown under rotation is excluded and also the rough grazing areas of the moors. The permanent grassland areas are all found at levels of about 400 to 600 feet which receive 40 to 45 inches of rainfall on an average. Some grassland, however, receives much above the average at the moorland edges and a certain amount exists on a rainfall of under 40 inches. The best grasslands are found in the south-east especially, and the middle and north-east divisions which correspond to the Tamar Valley. There is a northward continuation into Stratton. A further concentration occurs behind the coast between Looe and Fowey to the south of Hensbarrow where many prosperous farms are seen. The grasslands of the Lizard peninsula are fairly evenly distributed but are confined to the southern half. Small pastoral areas are found on the weathered granite masses but are extremely localised as in the Central Plateau of France where are similar small pockets of greater fertility. The alluvial wash at the base of granite bosses is also very fertile and supports a good permanent pasture.

Contrasted with the greater acreage under crops there is very little permanent pasture in Pydar. The moorlands of West Penwith, the high moors of Bodmin, Hensbarrow and Carn Menellis doe not support permanent grasslands. Neither do the

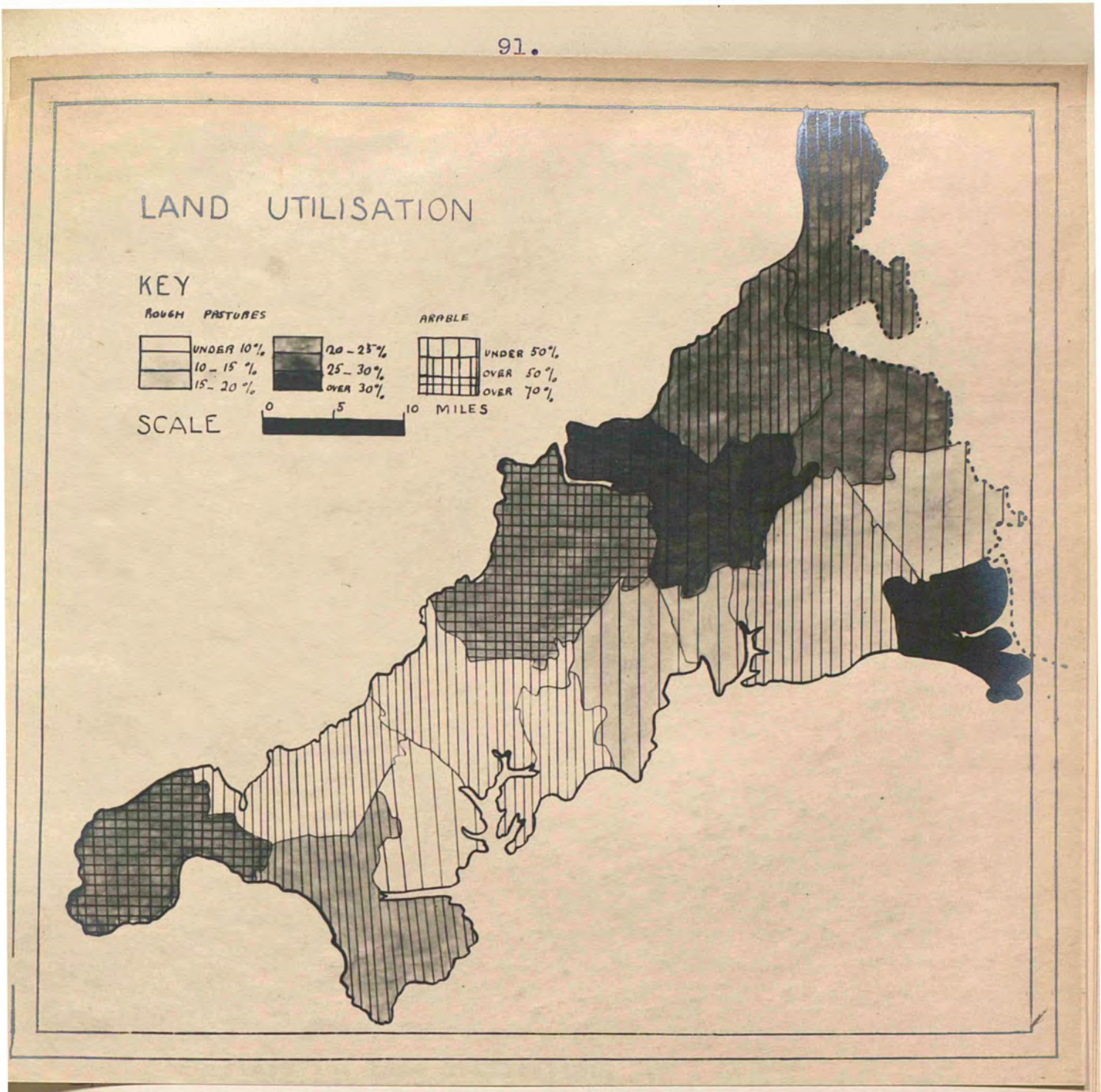


PLATE 15

(a) High percentage of arable in Penwith area and Pydar.
(b) Highest percentage of rough pasture in south-east and in Camelford areas.

N.B. Rough pasture expressed as percentage of total acreage.
Arable land " " " of cultivated area under crops and grass.

low lying but very restricted valley floors support a grassland cover since their use is primarily for market garden and other crops.

Rough pastures.

The percentage of rough pasture in each district when mapped offers interesting correlations with the grassland distribution, crop acreage and livestock maps.

The greatest extent of this pasture is found in the south-east where the crops are also dominant. What pasture there is, is mainly rough grazing land of use for some cattle but chiefly for sheep. Trigg has a similar percentage. Next come West Penwith, Lesnewth, Stratton, and the north-east. These are followed after a similar interval by West Kerrier and Pydar. East Penwith, East Kerrier, and West and South Powder are the lowest in the scale. In between comes a southerly belt consisting of East Powder, Tywardreath, West Hundred, and Middle divisions. There is thus a general arrangement in belts. As in the case of the dairy districts map there is shown clearly a gap between a western and eastern division, consisting of the central area which should be predominantly of mining interest. The rougher pastures are more often seen on the north coast than the south to which are restricted the better and richer pastures, especially in the south-east.

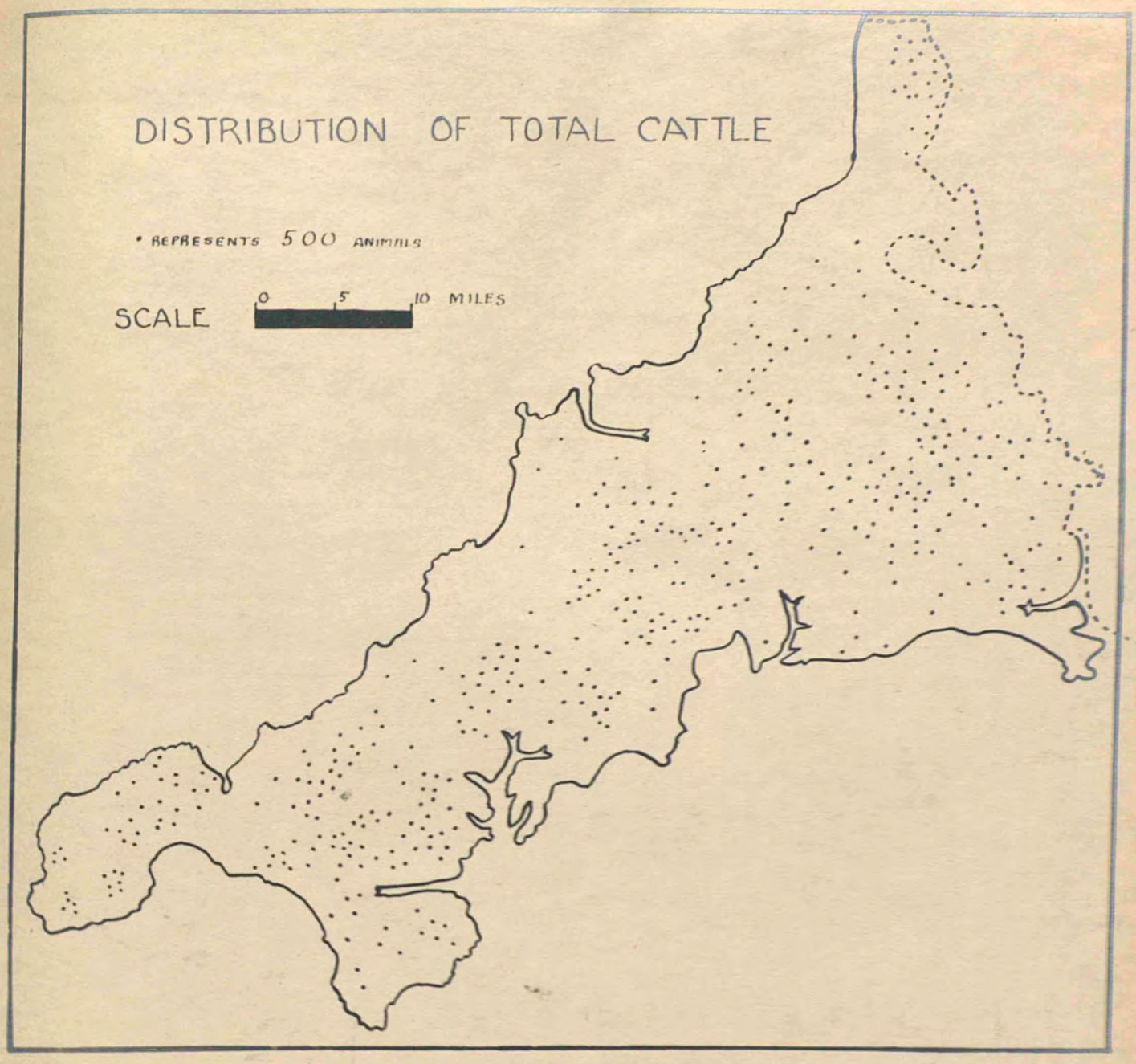


Plate 16. Distribution of Total Cattle.

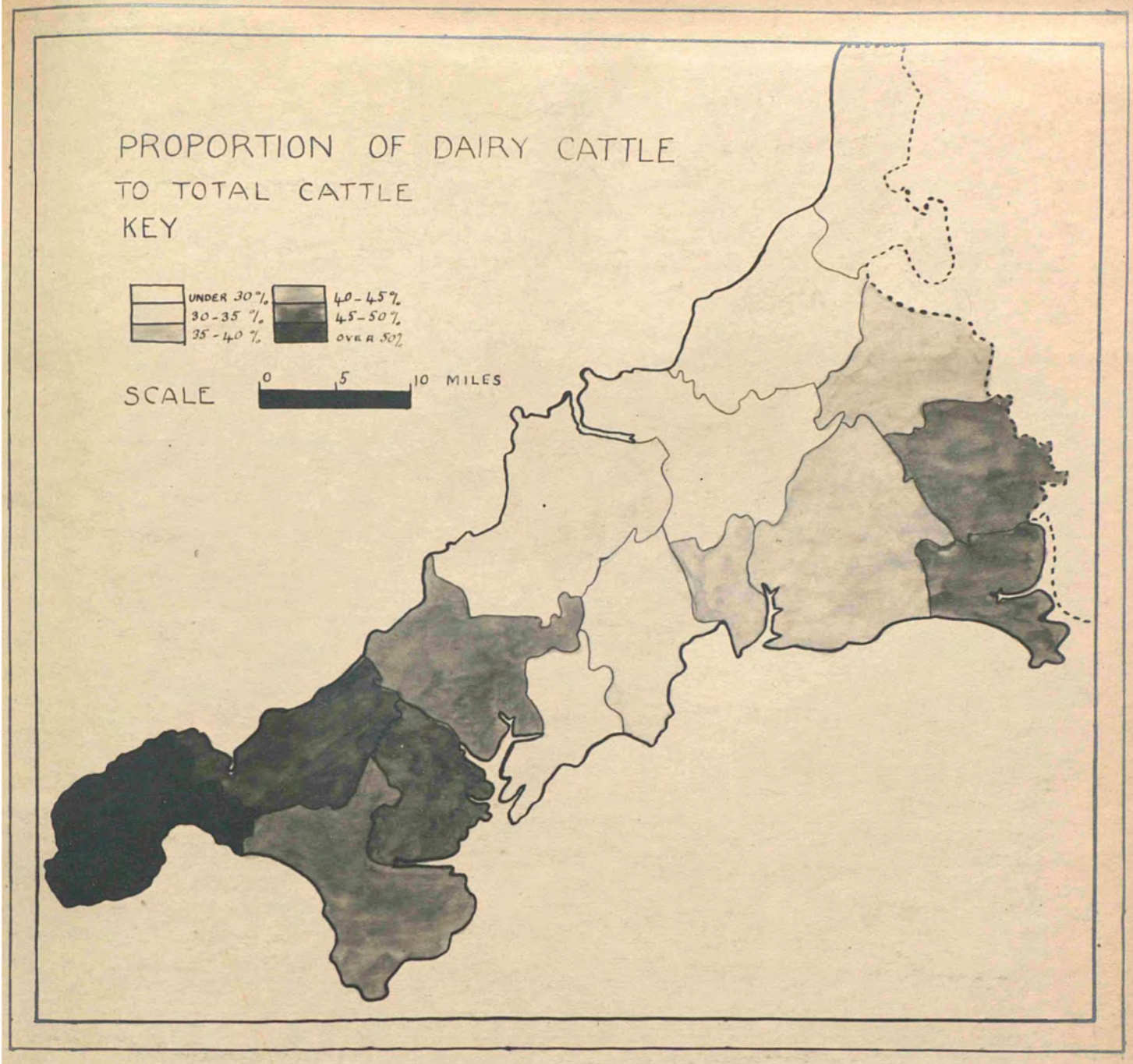


Plate 17. Proportion of Dairy to Total Cattle.

(a) Chief Dairy Districts - East and West Penwith.
(b) Moderate proportion in south-east.
(c) Very low proportion on central moorlands.

(e) Livestock.

Cattle.

In general the cattle distribution map shows a maximum density in the higher and wetter areas from levels of over 400 feet to about 600 and 800 feet. Regarding average rainfall no definite isohyets can be quoted accurately. The pastures vary exceedingly with this factor but cattle of different kinds are possible on the poorer or the richer. Confined to such areas, the detailed distribution is fairly even. Slate and granite soils predominate. West Penwith has many isolated farms where cattle are kept in considerable numbers. The two types of pasture mapped are both used for cattle but there is a greater concentration on the richer permanent pastures since the rougher grazings become too wet except where these are more suited to sheep. Consequently a more or less radial distribution is noticed around the granite masses, Bodmin Moor with an extension south-eastward, Hensbarrow, Carn Menellis, and West Penwith, but in the last case the farms are grouped in isolated areas. The Lizard peninsula shows a sparser distribution. Few are also found in the more purely agricultural district of Pydar. The central gap noticed on the pasture map is remarkable for a very sparse distribution of cattle.

The dairy cattle districts are more localised and emphasise the conclusions deduced from the permanent

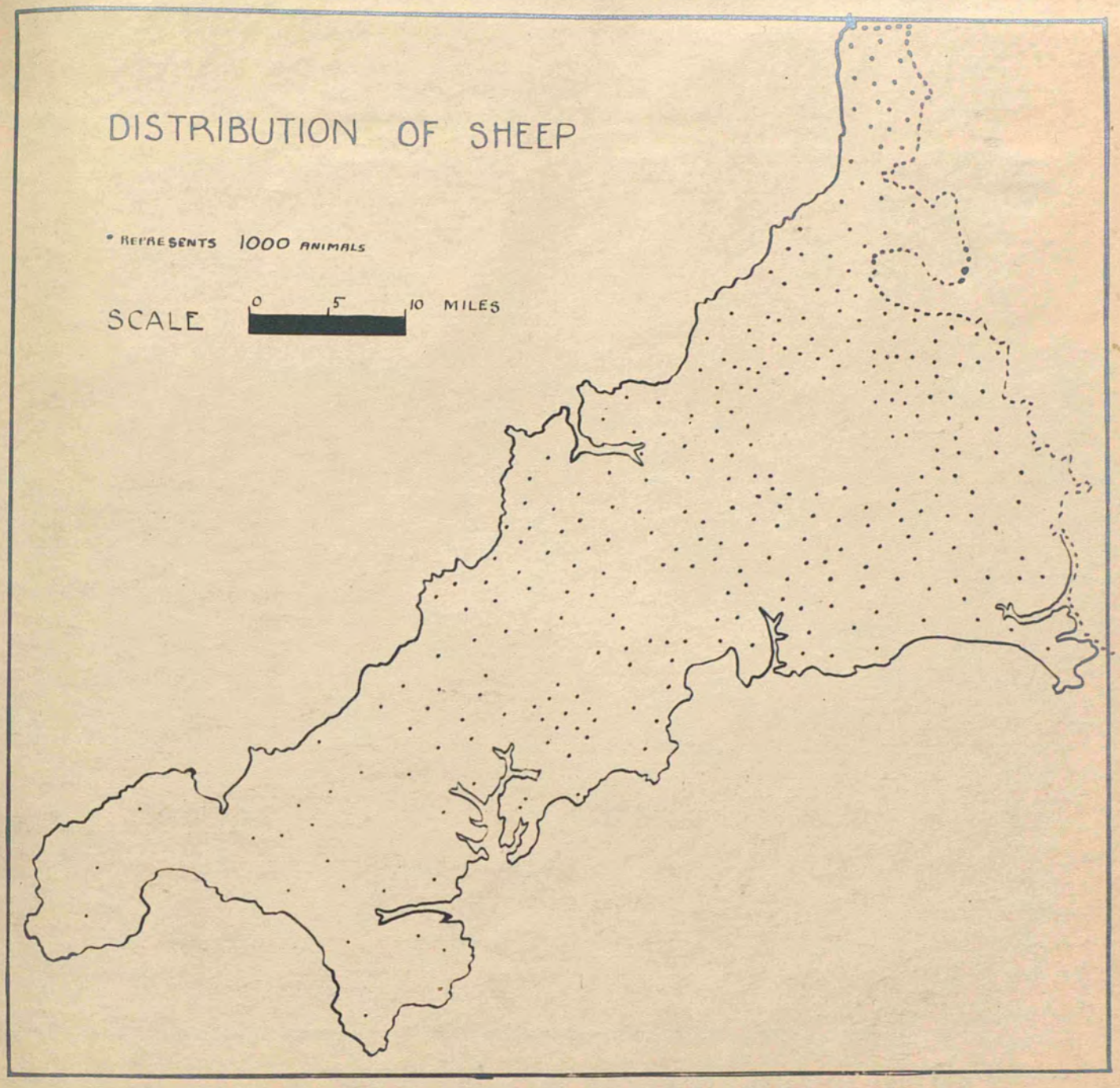


Plate 18. Distribution of Sheep.

grassland map. West Penwith has more than 50% of its cattle for dairy purposes. East Penwith and East Kerrier, and the Middle and south-east districts come next. West Kerrier and West Powder are not far below. A belt runs roughly south-west to north-east through Tywardreath, West Hundred and the north-east with over 40% of its total cattle for dairying. The northerly belt on the poorer pastures is naturally at the bottom of the scale regarding the dairy industry but has nevertheless a high percentage of cattle. South Powder is slightly lower than this belt. There is thus a pull to the richer areas of the south-east and the south-west, the south-west predominating. All the southern districts of better pasture are engaged in dairying to some extent.

Sheep.

Although in Cornwall both sheep and cattle are often seen in the same pastures where a small scale, mixed type of farming prevails, yet generally the sheep are restricted to areas slightly drier and rougher grazing land. The distribution is much more even and not specialised as is dairying. Evidently Cornwall is not a great sheep county. In Kerrier especially sheep and cattle are seen in mixed pastures. In the western dairy districts very few sheep are seen. The Lizard area, however, is not a great dairy district. The east and east middle are separated in distribution density from the west of the county but are themselves of a uniform distribution. The richer pastures bordering the Tamar are less

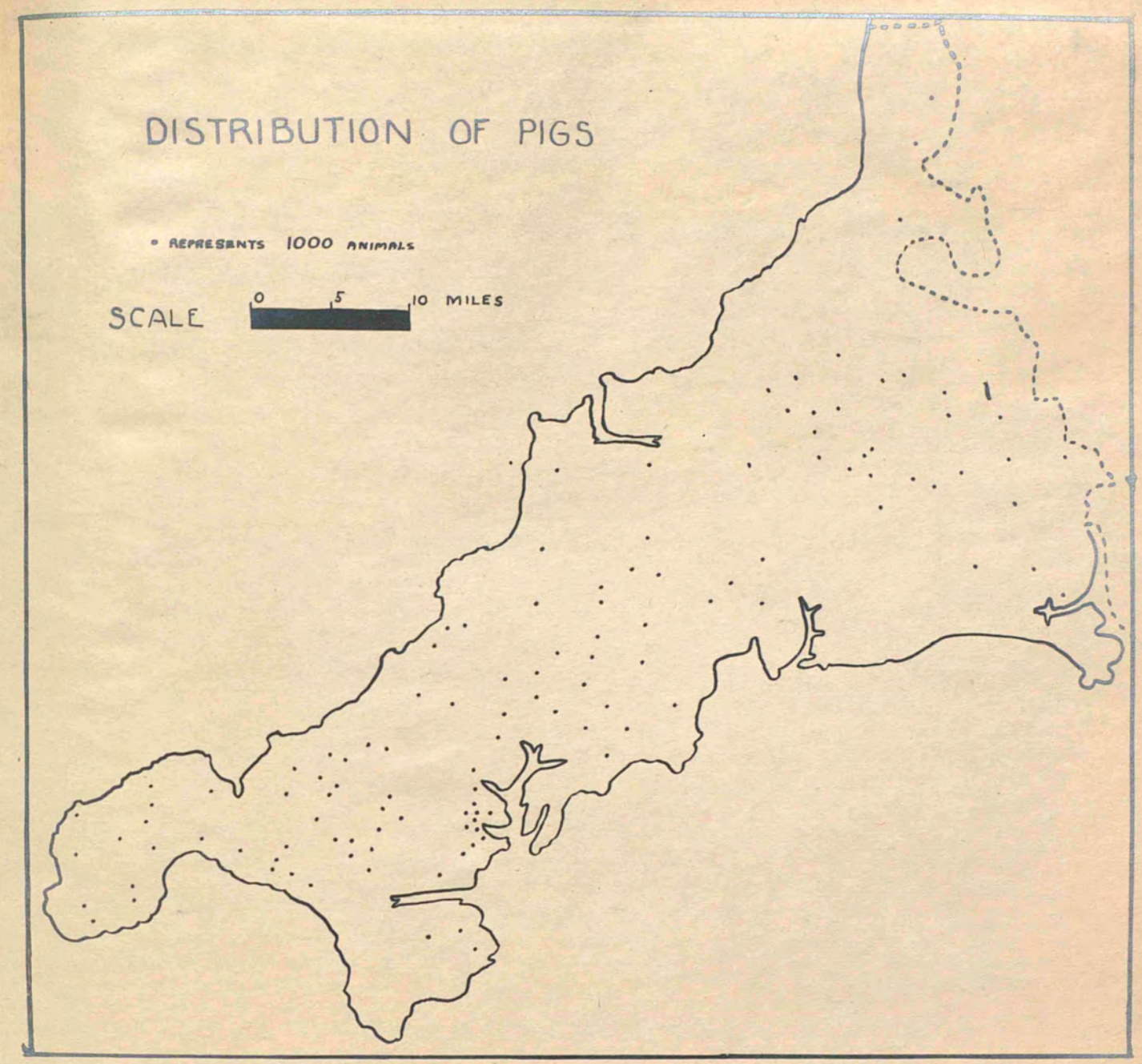


Plate 19. Distribution of Pigs.

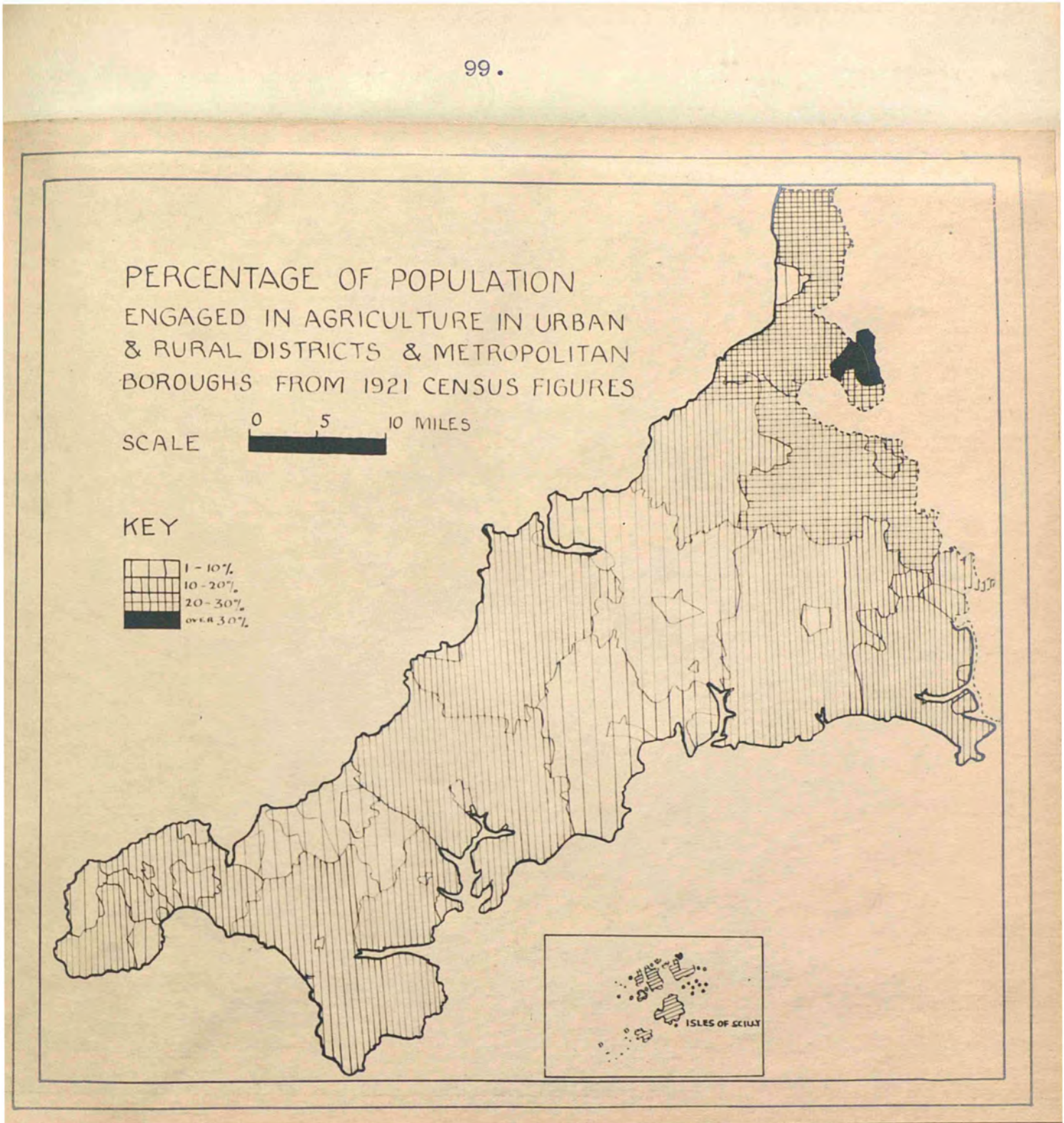


Plate 20. Percentage of Population engaged in Agriculture - 1921.

used for sheep than cattle. Both northern and southern districts are equally heavy with a slight preponderance of sheep over cattle on the rougher grazings to the north. It is usual to see from 20 to 50 sheep in an average sized field throughout Cornwall.

Pigs.

The distribution of pigs is less important and shows a great drop in numbers. It is interesting in so far as a correlation is possible between the dairy districts and the most dense distribution of pigs. None are found on the rough grazings to the north. There is a slightly more marked concentration round the market centres as at Helston, Truro, and other centres for agricultural districts. As in the case of sheep, pigs are also found on mixed farms to a very great extent in Cornwall.

Analysis of occupation map showing percentage of population engaged in agriculture.

This map shows very clearly the predominant importance of agriculture within the County. A consideration of the Census figures shows that of 1,000 people occupied in some way within the County as many as 224 are engaged in work connected with agriculture. There are naturally considerable variations but on the average 76 per 1,000 are so occupied in Urban

in Urban districts and 332 in Rural districts.

1. Very much more uniform spread than either fishing or mining maps similarly constructed.

2. Even the least agricultural areas show a heavier shading, therefore everywhere agriculture is the staple industry.

3. There is not the same variation between high percentage and low percentage areas - no striking cores or very sparse areas.

4. Shows greater correlation with soil map than with rainfall map.

5. Very similar percentages for all market garden areas.

6. Eastern districts show a gradual transition to higher percentages of Devon.

7. Greatest break in shading comes in the neighbourhood of granite.

8. A definite break, however, where conflicting Borough interest, even when an Urban district; still greater if Rural.

9. Only a very general correlation is possible between agricultural, mining and fishing percentage maps.

10. Continuation of West Penwith shading is an anomaly but

explained by geological map which shows many fertile soils as well as serpentine.

Actual Densities.

1 - 10% grade.

East Penwith and Bodmin and St. Austell areas - mining interests also.

10 - 20% grade.

Remainder of area except districts bordering the Tamar.

20 - 30% grade.

Middle and north Tamar districts.

Above 30% grade.

Holsworthy only - transition area.

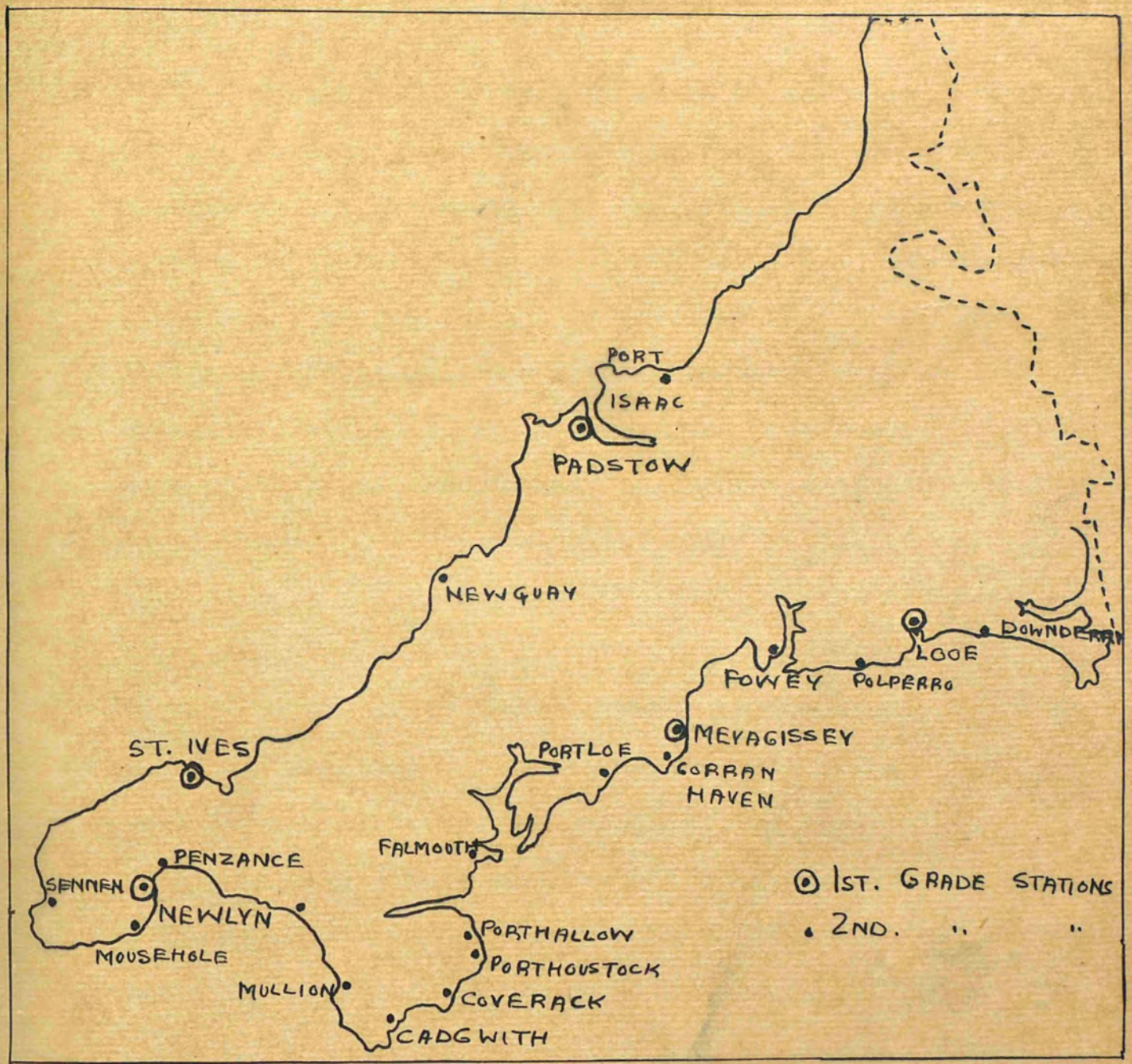


Illustration 23. Diagram showing Fishing Stations.

CHAPTER V.

The Fishing Industry.

The fishing industry, although of secondary importance, has always been one of the main sources of wealth of the Cornishman. This is no less the case at the present time, although statistics show a general decline in the total catches. Every small village on either coast is to-day to a very large extent dependent upon the fishing industry which may constitute either a full time or part time occupation. As such it is indispensable and, therefore, modern research should do all that is possible to improve the present conditions which in the case of pilchards and herrings, migratory fish, are due to lack of knowledge regarding fish migrations and their causes. Once the causes are known it should be possible to counteract them and bring again, in some measure at least, prosperity to the industry.

There is little mention of fishing in Cornwall before Elizabethan times. Carew writing in 1602 mentions "mackrell" and pilchards. Of the mackerel Barlase in 1758 said "mackrel is taken in great plenty on the south coast of Cornwall . ..... not only of use when fresh but salted and pickled and kept till the winter to the great relief of the poor". Transport difficulties were then more acute so that it is reasonable to suppose a large surplus was not despatched outside the region. By the mid-nineteenth century

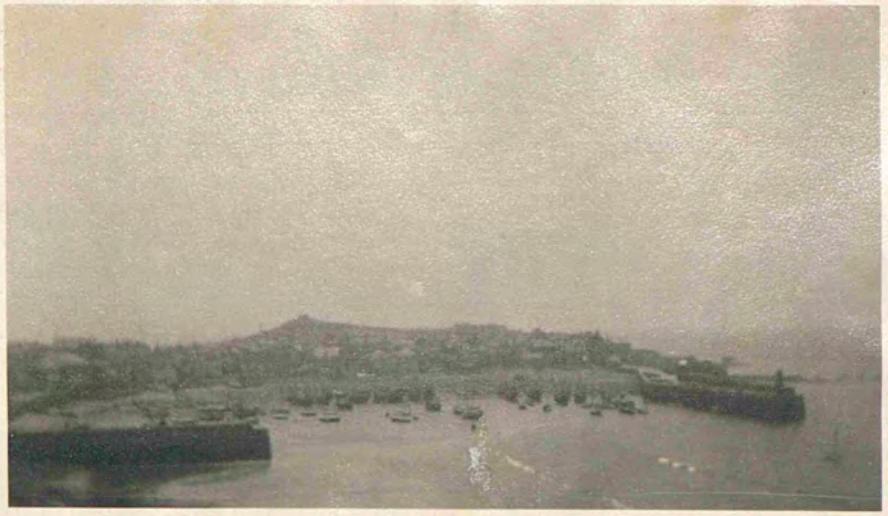
a lugger was fitted at Polperro large enough to carry 1400 fathoms or 1½ miles of nets. The completion of the London to Penzance main rail line in 1859 had a great effect on the development of the west as a source of supply. A year later fish to the value of £80,000 was despatched from the region. Methods of capture and size of boats increased in efficiency and size and in 1896 there was a large influx of fishing vessels from the East Coast ports. The local Report for 1905 gives some interesting details. Of the 500 boats used there were 20 from Porthleven, 80 from Newlyn, 50 from Mousehole, 80 from St. Ives and 270 from the East Coast ports. The spring mackerel fishery is stressed when the fish congregate off the south-west coast and of which Newlyn is the centre in February and March to May. Later the fish appear to move west-south-west of the Wolf Rock. Of a total of 300 boats engaged in drift net fishing there were 60 in the district east of the Lizard, 150 in Mounts Bay, and 80 at St. Ives. Seine fishing was more important at St. Ives and to the east of the Lizard. The pilchard fishery is older established but has declined in importance and cannot be relied upon to any great extent since it is subject to great fluctuations due to migrations in search of food which is planktonic.

With regard to general conditions of the industry the most striking fact which influences all development is the fact

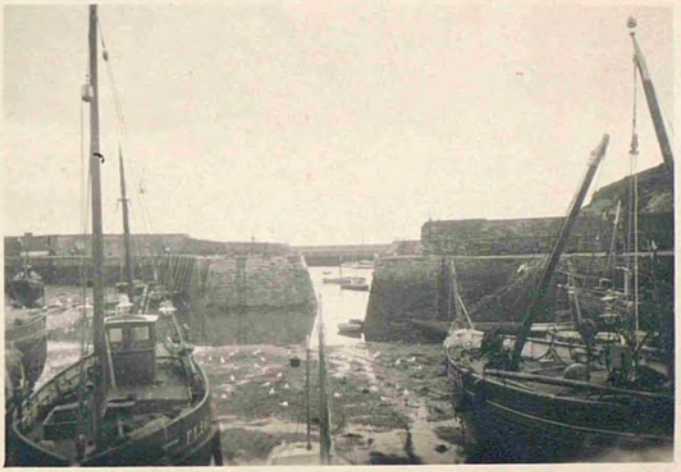
that the South-Western Sea Fisheries District is in itself the transition zone between two kinds of fish. It is the northern limit of the pilchard which is pelagic and has pelagic eggs which float (due to the presence of an oil globule) and also the southern limit of the herring which is pelagic but has demersal eggs. Whereas the herring come inshore for spawning the pilchards move to deeper waters. It has been suggested that the spawning grounds could be studied and in some way protected. The occurrence of mackerel and plaice ensures a continuous fishery throughout the year. Cornwall is the leading fishing county on the south coast and employs about 50,000 hands. The average value of catch yearly is ¼ million sterling but fluctuations are great. The total catch is confined to net fishing - by seine and drift - as contrasted with the east coast district which employs the trawl. The one exception to this statement is Newlyn, which does employ large steam trawlers to some extent. The seine fishing at St. Ives is characterised by periods of feverish activity followed by a long idle time for the fishermen. When the pilchards visit the shores they arrive in huge shoals which cannot be handled efficiently. A haul of 8,000 hogsheads at St. Ives has been recorded which, however, decomposed before landed.

Fishing stations of both major and minor grades occur at frequent intervals all round the coasts. Every inlet has its fishing village especially on the south coast.

A contrast is noticed between a typical village of the north-east coast and one of the south coast both with regard to building and construction of the harbour and to type of fish caught. The change in construction of harbours is a most interesting and striking fact when visiting one village after another round the Cornish coasts. Here is a proof of the great influence of wind direction and wind force on the fishing since in some cases an inner and outer harbour are considered essential; in other cases there is a single harbour. Stations experiencing very strong south-westerly gales have the added protection afforded by a double breakwater. Mevagissey is the most typical example of a south coast fishing village. Fishing is carried on throughout the year with little, if any, break. The spring mackerel fishery continues throughout March to June and is followed by pilchard fishing from July to December. The winter herring season continues until late January. Large mackerel drifters and smaller pilchard boats are used, all of which employ a share system. The catch is sold to "jowders" or fish hawkers - probably a Celtic word - except the mackerel which are auctioned. The completion of a new pier has made the station second only to Newlyn from which larger station a great amount of the Mevagissey catch is despatched by rail. During a day at Mevagissey in July almost all the catch was despatched by road on lorries to Newlyn where with a large total from Newlyn



St. Ives Harbour - North coast type.



Mevagissey showing inner and outer harbour - South coast type.

Porthleven - South coast type - showing fishing fleet in outer harbour.

itself it eventually reached the main line at Penzance and was despatched by rail. In a good year this station may catch on an average ¾ million mackerel, 16 million pilchards and about 2 million herrings. Figures are often misleading since not all the fish caught in this case in Mevagissey Bay are landed at that station. A great deal finds its way to Plymouth. Mevagissey is a self-contained fishing port. Sails, boats and nets are made and a sardine factory - the only one in the west - has been established here. Industries connected with the cleaning and curing of the fish have grown up on the spot. The sardine trade has given rise to tin soldering operations and cutting of the tin by machinery.

St. Ives is typical of the north coast fishery. It is the centre of the seine fishing. With regard to species it is a curious fact that two allied fish - pilchards and herrings - have been known to come inshore in different seasons. This is a biological phenomenon and has not yet been satisfactorily explained. It may be compared to the sprat and herring catch of the south Devon coast. September to November is the pilchard season at St. Ives. It is then that regulations are needed since more than 250 large seines are employed by different owners in a limited space. There are only six stations or "stems" from which fishing by seine is possible and, therefore, no other boat may come at that season within a certain fixed distance of these "stems". Enormous shoals have

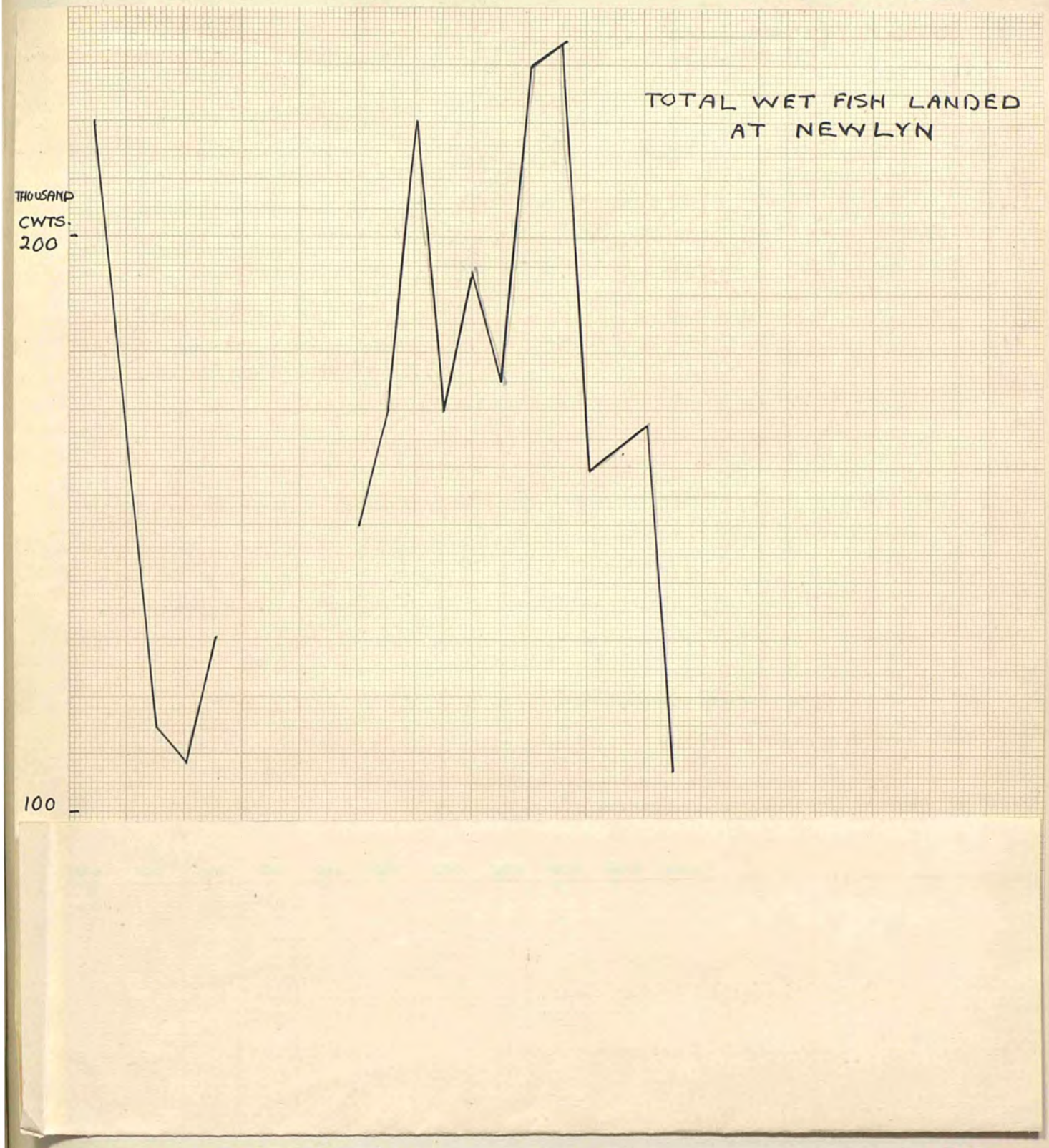
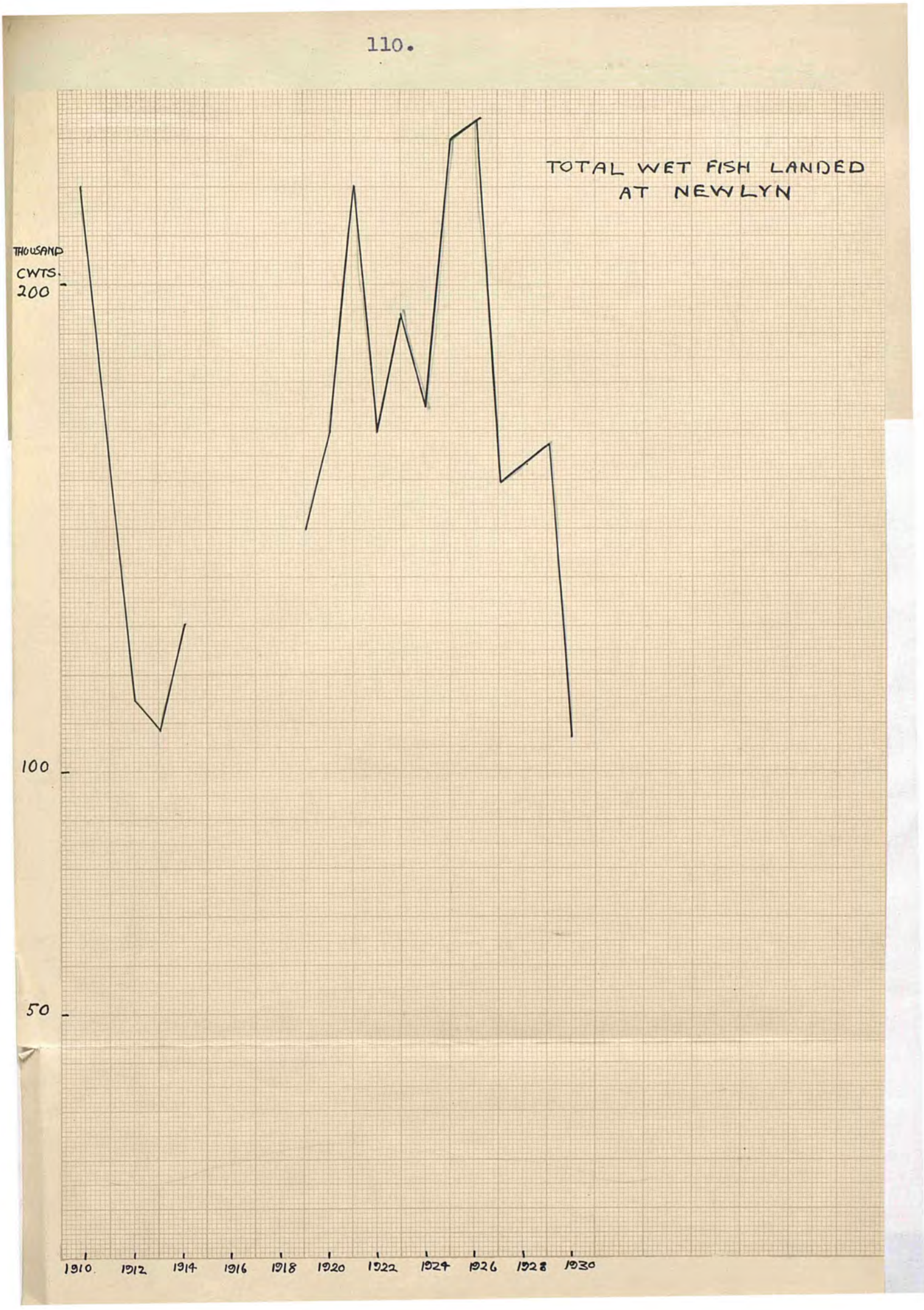


Illustration 24. Graph of Catch at Newlyn 1910-30.


TOTAL WET FISH LANDED AT NEWLYN
THOUSAND CWTS.
200
100
50
1910
1912
1914
1916
1918
1920
1922
1924
1926
1928
1930

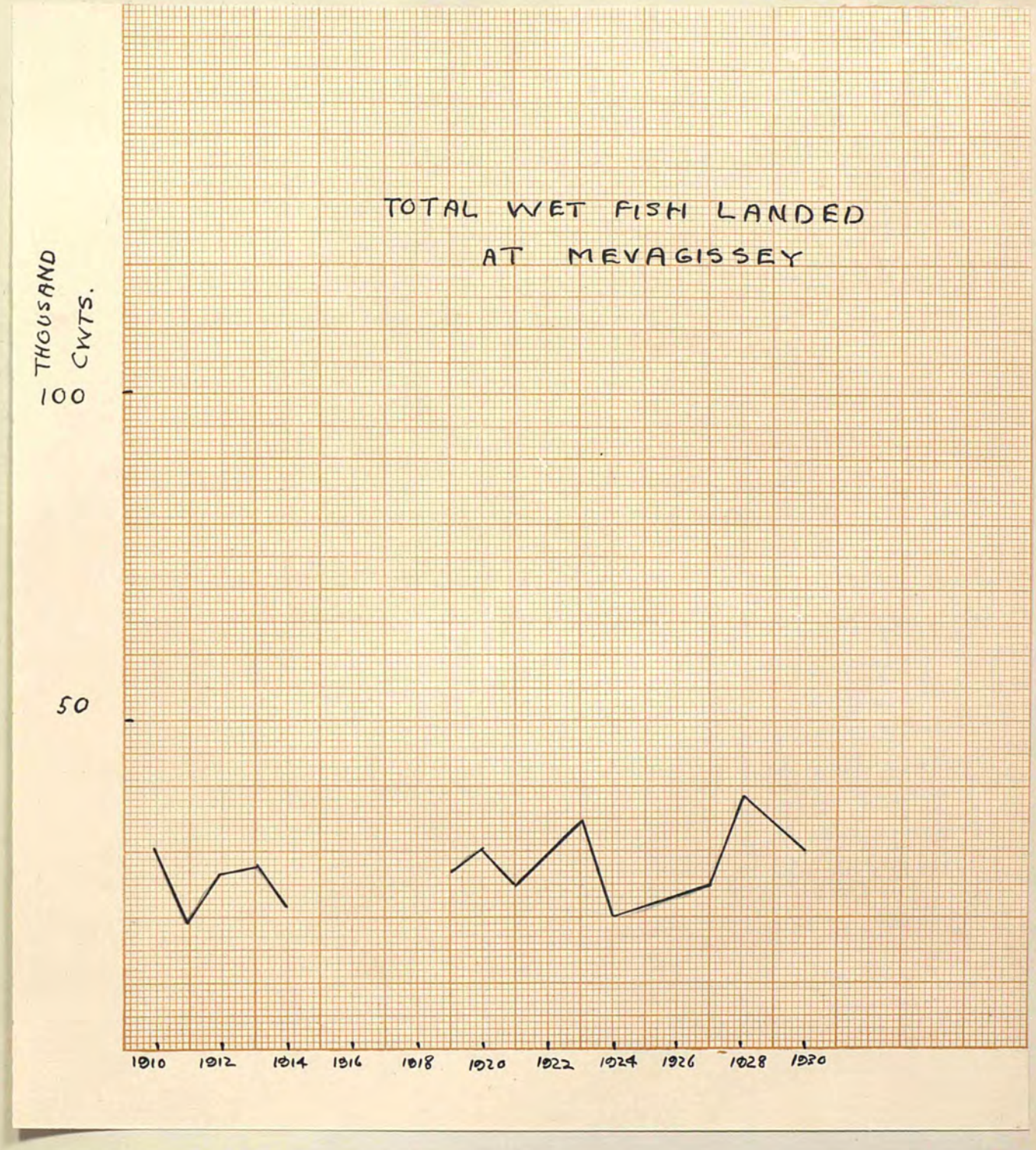


Illustration 25. Graph of Catch at Mevagissey. 1910-30.

been taken at St. Ives in past seasons. A curing trade has grown here and the product is exported to the Italian market. The early connection with Italy is driven home by the existence of a silk mill near the harbour which has worked for many years.

Newlyn.

The graph showing total wet fish caught each year (excluding the war period for which no statistics relating to separate stations are available) indicates a downward trend since 1926. The immediate post war period shows a gradual recovery with some bad years but generally an upward trend until 1926. The low catch of 1913 is not again recorded until 1930, the figure for which is slightly lower. It seems that this station is losing to Mevagissey and stations further eact. Regarding recent movements of fish, stations in the extreme west are badly placed. This station still heads the list but seems to be declining rather rapidly. The fish appear to be moving gradually further up the Channel and the conditions at the Devon stations are improving.

Mevagissey.

This is easily the second station of the south coast and appears to be gaining since 1924. The 1928 catch is the highest recorded within the period taken and the 1929 catch is not far below. Each peak reached is higher than the preceding one which seems to argue in favour of greater development.

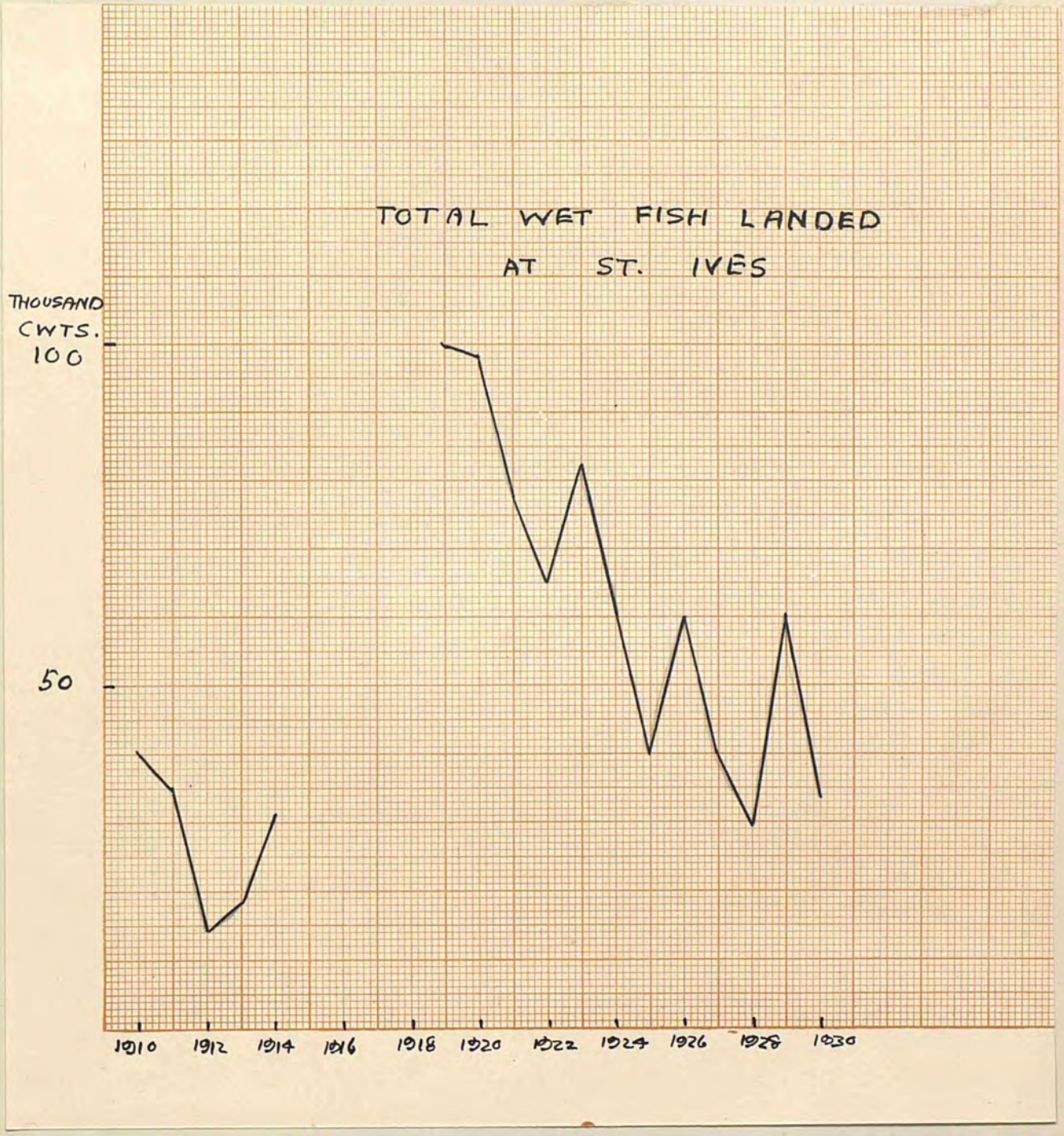


Illustration 26. Graph of Catch at St. Ives. 1910-30.

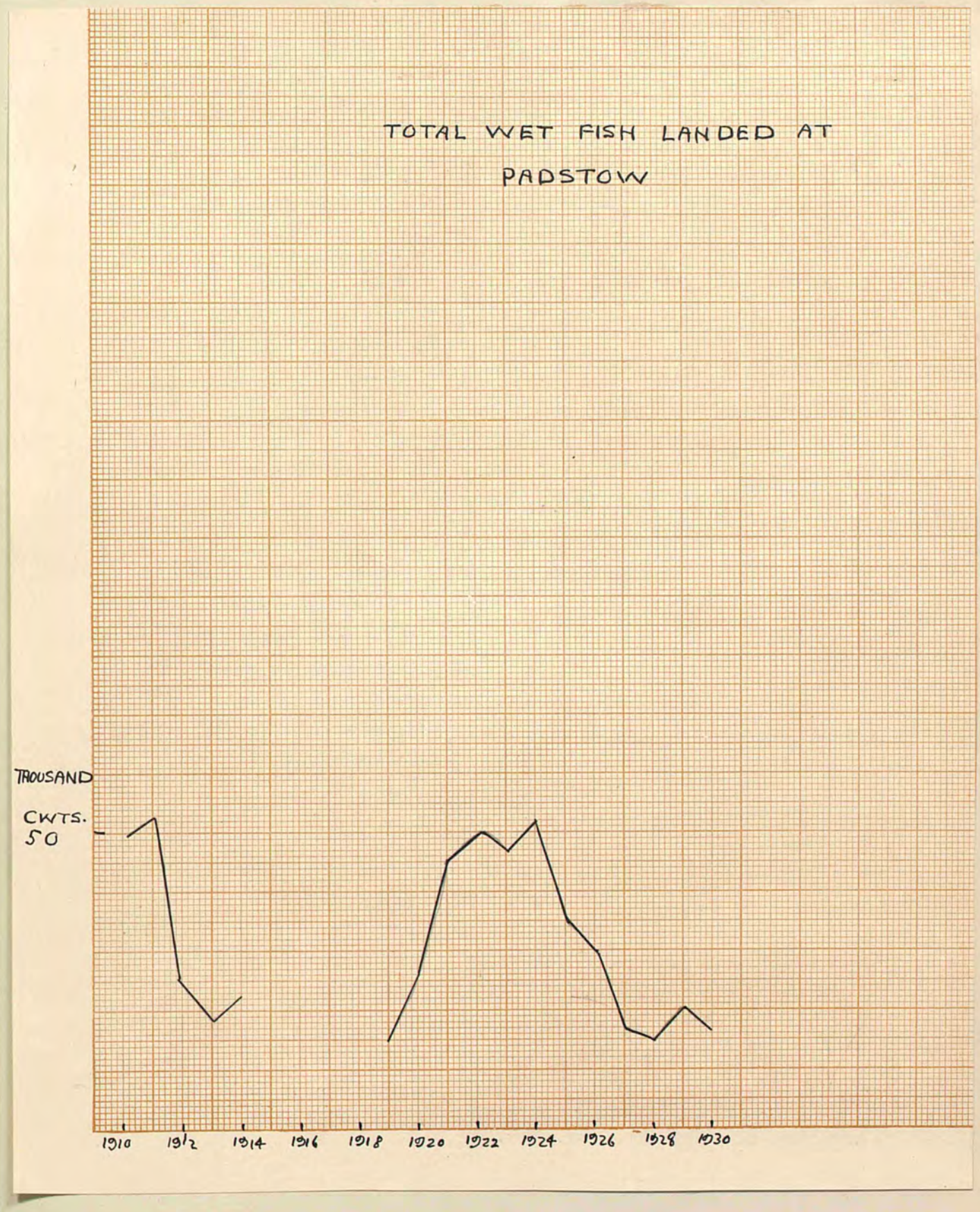


Illustration 27. Graph of Catch at Padstow, 1910-30.

St. Ives.

The fishing at St. Ives appears to have begun a gradual but definite decline since the war period, although some signs of slight recovery are apparent in the last few years. The seine fishing for pilchards which is centred here has declined owing to migrations of the shoals and until more is known regarding these, is not likely to be restored. The catch has now almost reached the low level of the pre-war period. Since the war Newlyn and the south coast ports and even stations further east in Devonshire have enjoyed better pilchard fishing than St. Ives, formerly, previous to 1910, the centre of the industry.

Padstow.

At this station recovery was rapid after the war period and reached the pre-war level but has since declined gradually. In recent years, however, a slight recovery is indicated. The pilchards especially are moving further north and east.

Some consideration of the pilchard fishery is here of special interest. As previously stated the pilchard is a species of the herring family and is pelagic, feeding on plankton. It is gregarious and migrates in shoals in search of food or possibly at the spawning season. It is thought that these migrations whether on a large scale or on a smaller scale as in diurnal migrations are due to changes in temperature, ocean currents, and wind directions. It appears

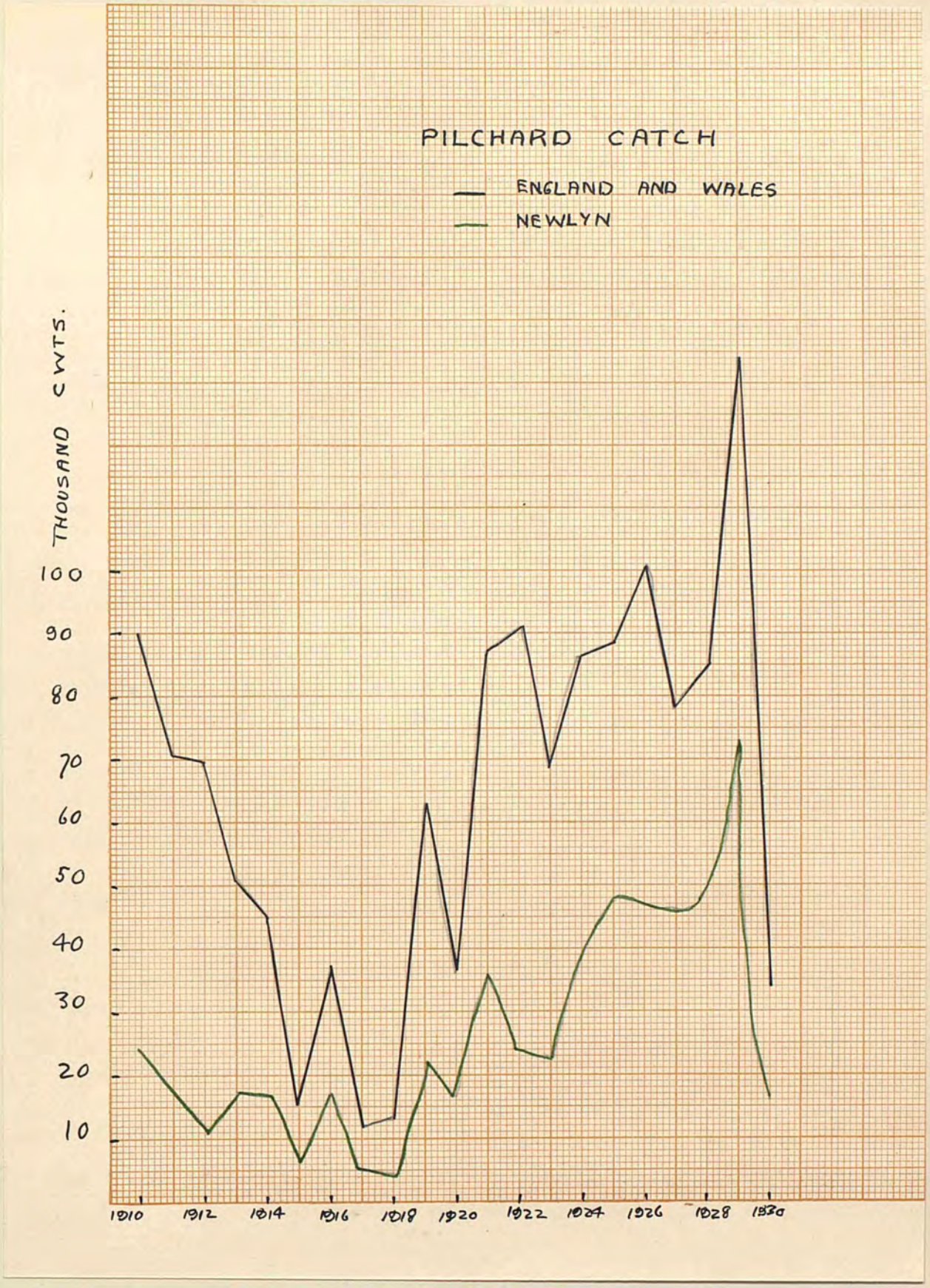


Illustration 28. Pilchard Catch of England and Wales and Cornwall.

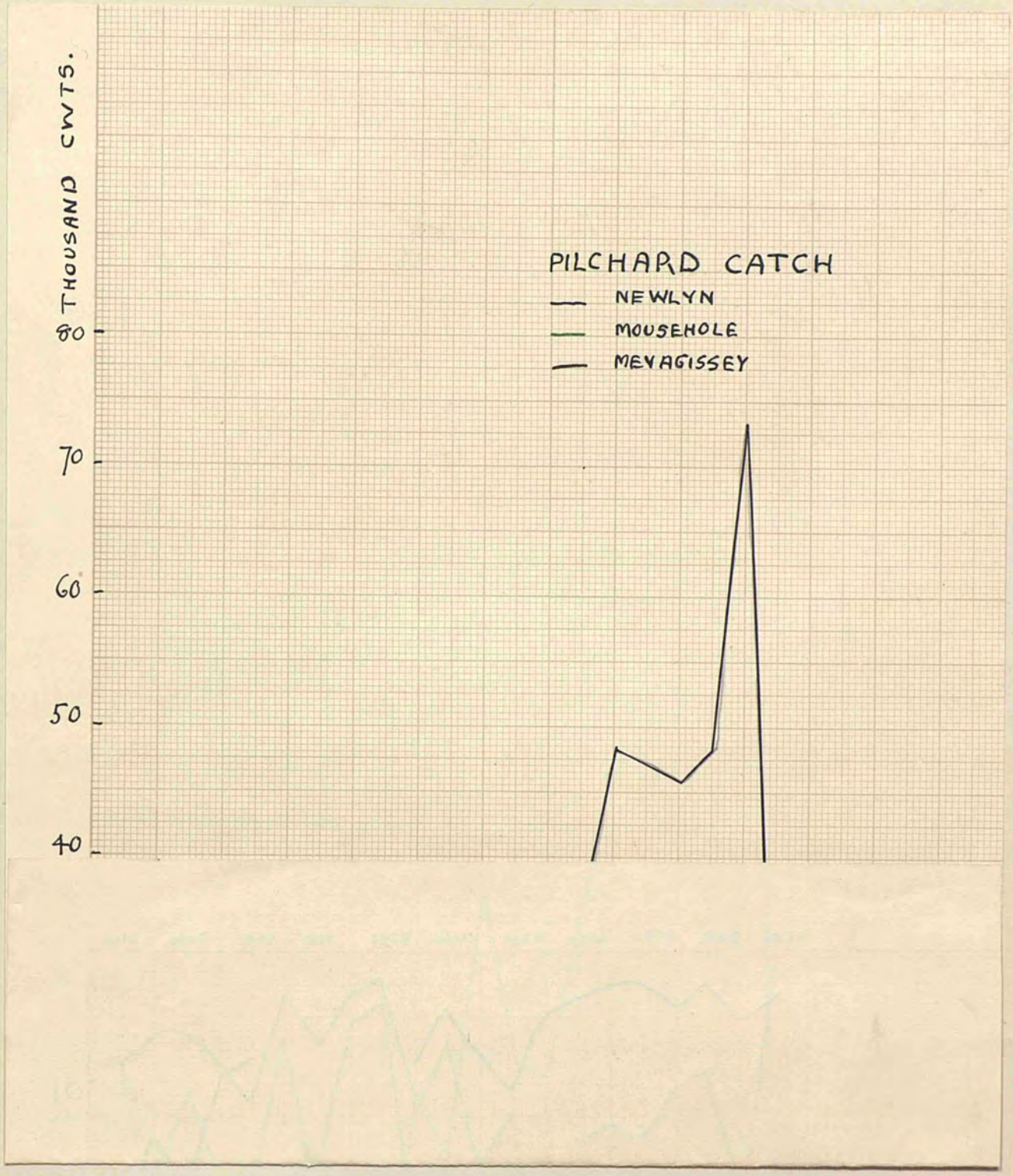
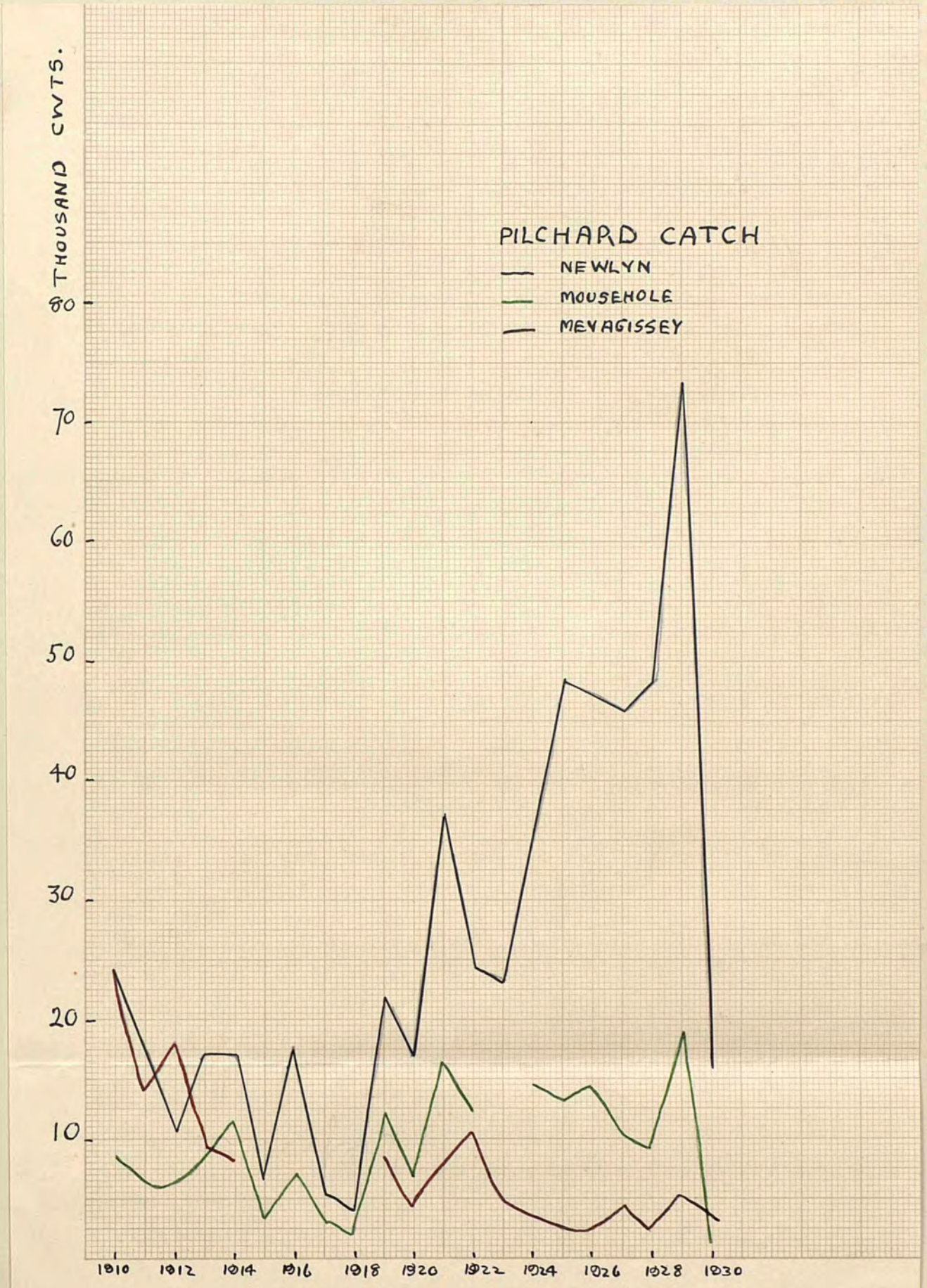


Illustration 29. Pilchard Catch at Cornish Stations.


THOUSAND CWTS.
80
70
60
50
40
30
20
10
PILCHARD CATCH
NEWLYN
MOUSEHOLE
MEVAGISSEY
1910
1912
1914
1916
1918
1920
1922
1924
1926
1928
1930

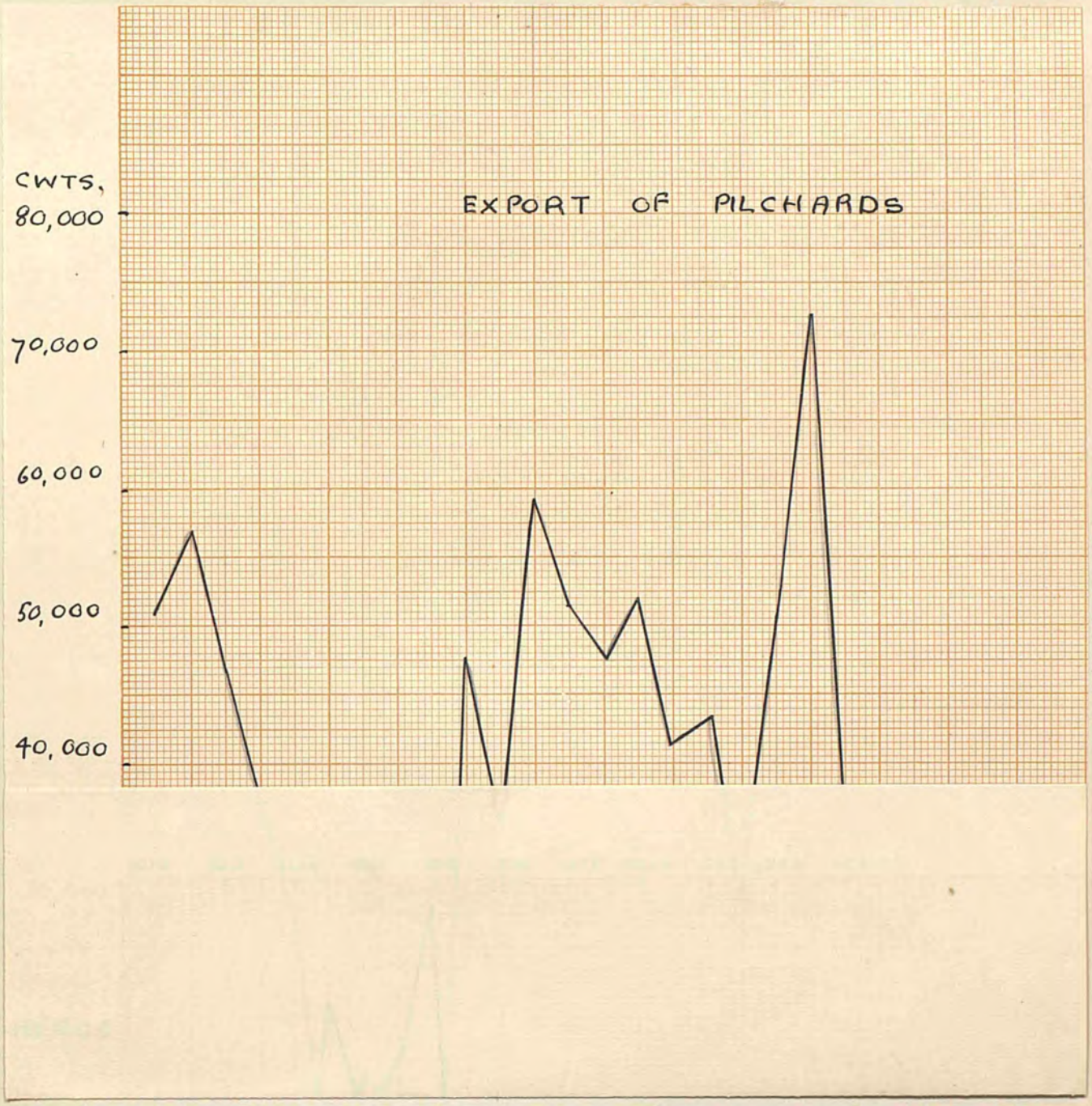
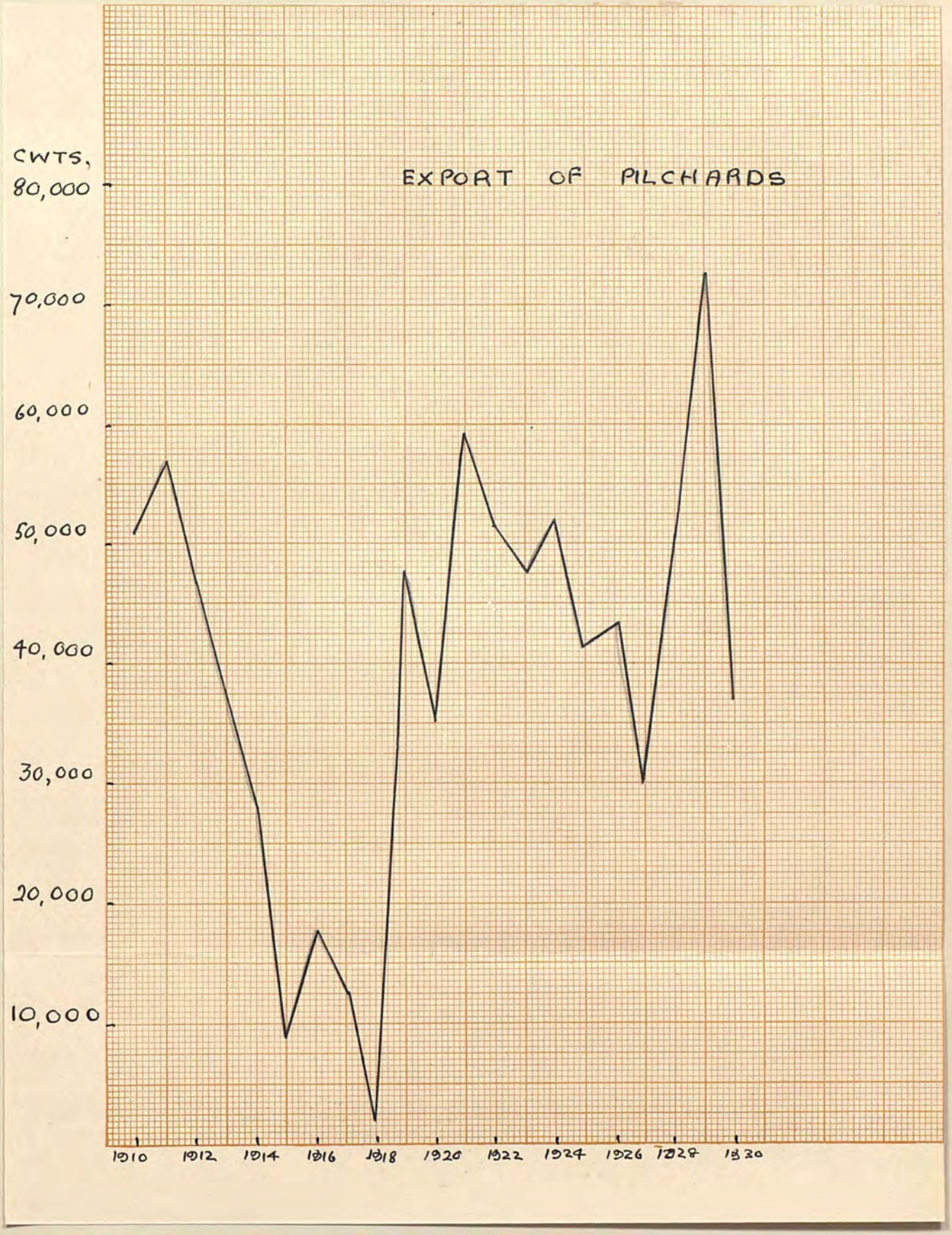


Illustration 30. Export of Pilchards.


EXPORT OF PILCHARDS
CWTS.
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
1910
1912
1914
1916
1918
1920
1922
1924
1926
1928
1930

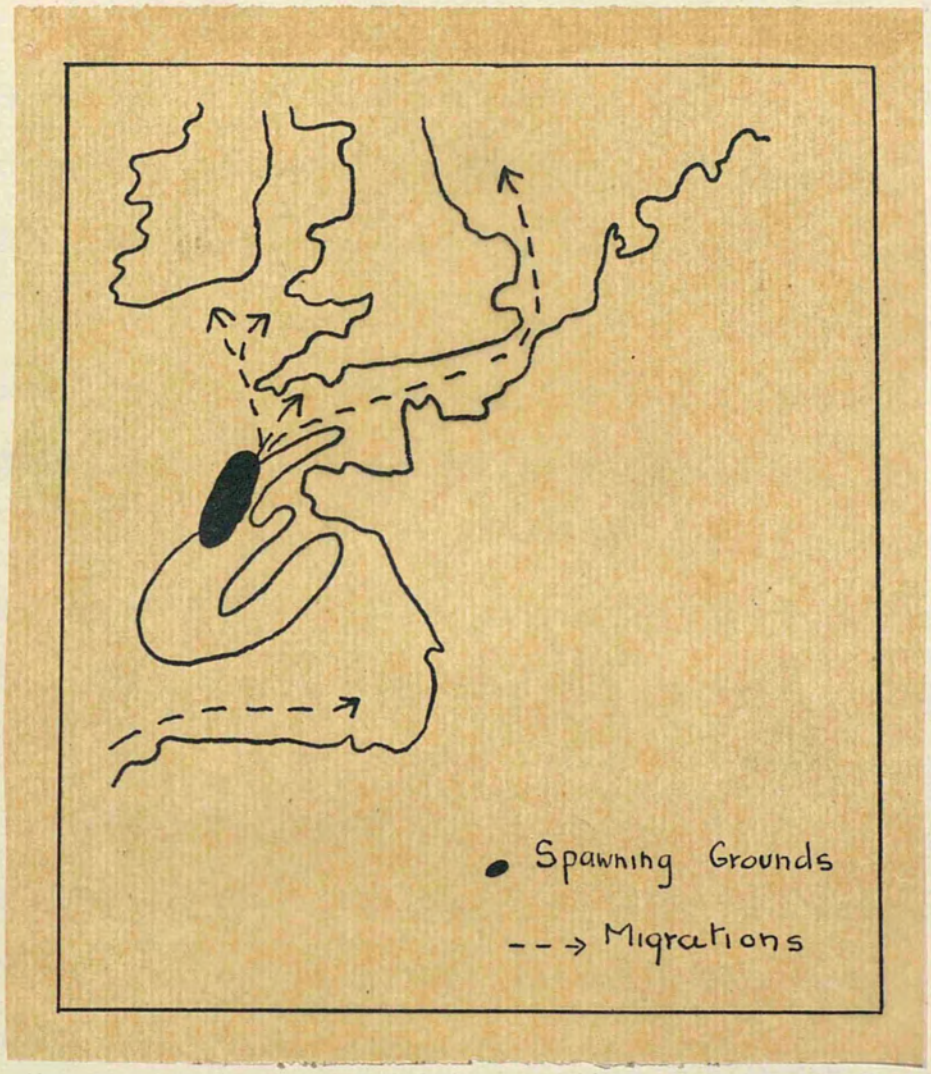


Illustration 31. Diagram showing Spawning Grounds, from Meek - Migrations of Fish.

that these fish are quick to notice any sudden change or disturbance. The migrations occur from shallow to deeper water in each case since the pilchard comes inshore each night. In January the fish are near the bottom and are caught when leaving for deeper waters. They reach a distance of from 20 to 50 miles off the coast; one stream migrates in the direction of St. Georges Channel and another as far east as, perhaps, Southampton and may penetrate the North Sea.

The pilchard fishing season at St. Ives begins in October. On the south coast the drift fishing begins in July and is followed by seine fishing in August. There are three main districts connected with the fishery - east of the Lizard up to Dawlish in Devon, from the Lizard to Lands End and the north coast region as far north as Padstow but centred at St. Ives. At any given season only one district may enjoy good pilchard fishing. It is now an established fact that the sardine of commerce is the young pilchard which is caught in Mediterranean waters before reaching the Cornish districts as a more mature fish. Growth continues for two or three years. In the Channel Islands a catch of pilchards of the sardine size has been recorded. Since the fish move in shoals it is almost impossible to deal with a large catch which is wasted and these exceptional hauls are then followed by a period of scarcity causing a very precarious condition. The pilchard has been known to reach the North Sea and Norway but there has been

no record since 1871. In 1838 with reference to Scottish fishing Parnell stated - "the pilchard has become a very rare fish in the Firth of Forth as well as along the whole eastern line of Scottish shores". With regard to the spawning Couch mentions two seasons - spring and autumn, but does not imagine the fish are on both occasions the same. In the warmer, later season the shoals come nearer the shores. In contrast to the herring which has demersal eggs the eggs of the pilchard are pelagic and an oil globule is present. The herring comes inshore and the pilchard seeks deeper waters in the spawning season. The location of the probable spawning grounds is important since these could be studied accurately and preserved to some extent. Statistics, as shown by the graphs, of the pilchard fishing indicate a gradual increase in the catch in England and Wales and at Newlyn since the war period (for which figures are available). 1930 seems to have been a bad year generally and it is yet too early to state whether a further decline is indicated or not. This last drop is a feature of all the stations. Mevagissey seems to be losing to Mousehole since the war, with regard to pilchards only, which station in 1929 had a greater pilchard catch than Newlyn. The catch at other stations fluctuates enormously and all are below those mentioned. The figures for St. Ives and other north coast stations are not worth plotting since they have very greatly fallen off since 1910. The south coast is at present the most favoured as regards pilchard fishing.

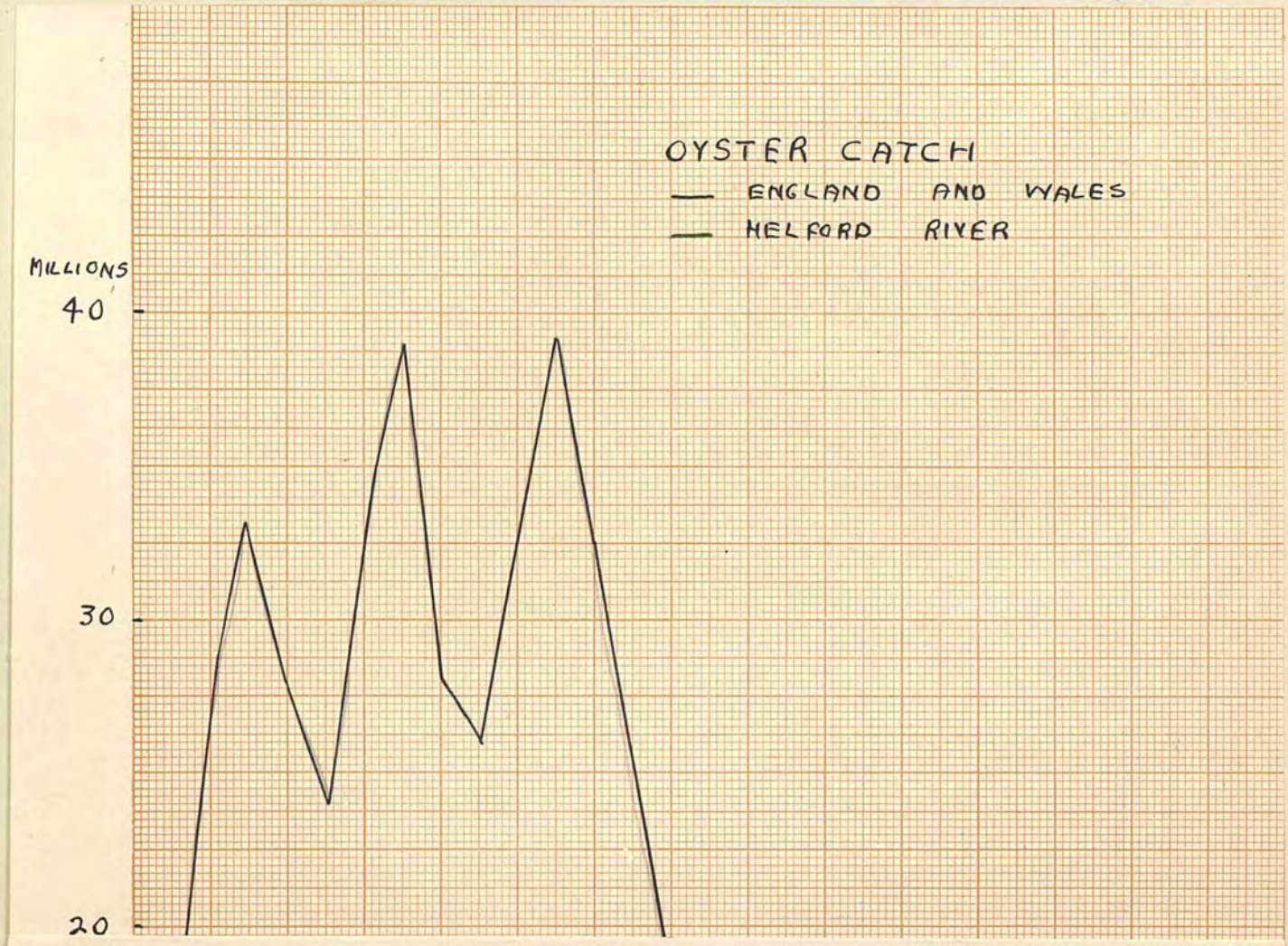
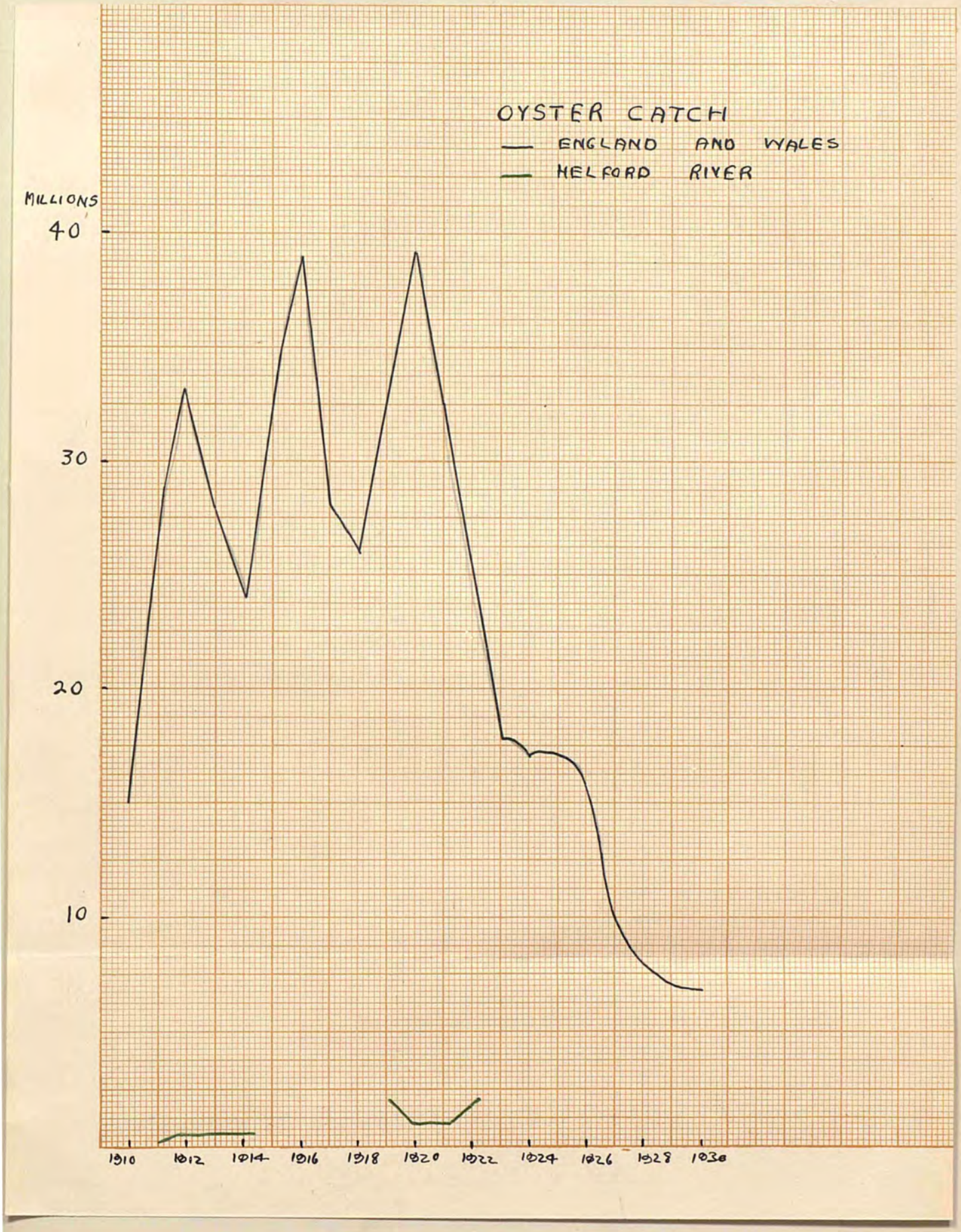


Illustration 32. Oyster Catch.


OYSTER CATCH
ENGLAND AND WALES
HELFORD RIVER
MILLIONS
40
30
20
10
1910
1912
1914
1916
1918
1920
1922
1924
1926
1928
1930

The pilchards are exported chiefly to Italy. The graph almost coincides with that showing total catch in England and Wales since a large proportion is exported and the rest consumed locally. None are sent to other parts of England since they decompose very easily unless cured.

The oyster fishery of the Fal estuary and Helford River is interesting and was studied in 1919 by Dr. Orton with a view to development. The Helford River district appears to have the greatest catch but the Falmouth and Truro beds are of a great extent. Compared with the east coast fishery of the Thames estuary that of the west appears insignificant but is capable of development. In addition to this very many oysters are sent annually to oyster districts of France. It is, therefore, to some extent a breeding ground. Previous to investigation the area had begun to show signs of exhaustion. The area in question is of about 4,000 acres in extent and the beds stretch from Truro to the mouth of the estuary. North of Mylor and St. Just belongs to the Truro district and south of this to Falmouth. The Helford area especially had become somewhat exhausted and, therefore, restrictions on size of oysters taken and on dredging were needed. In October 1919 an extensive survey was begun at the end of which it was found that the stock of small oysters was in a dangerous condition and would probably at the existing rate of depletion be non-existent by about 1927. Since growth takes from three to four years it was also predicted that a bad season for

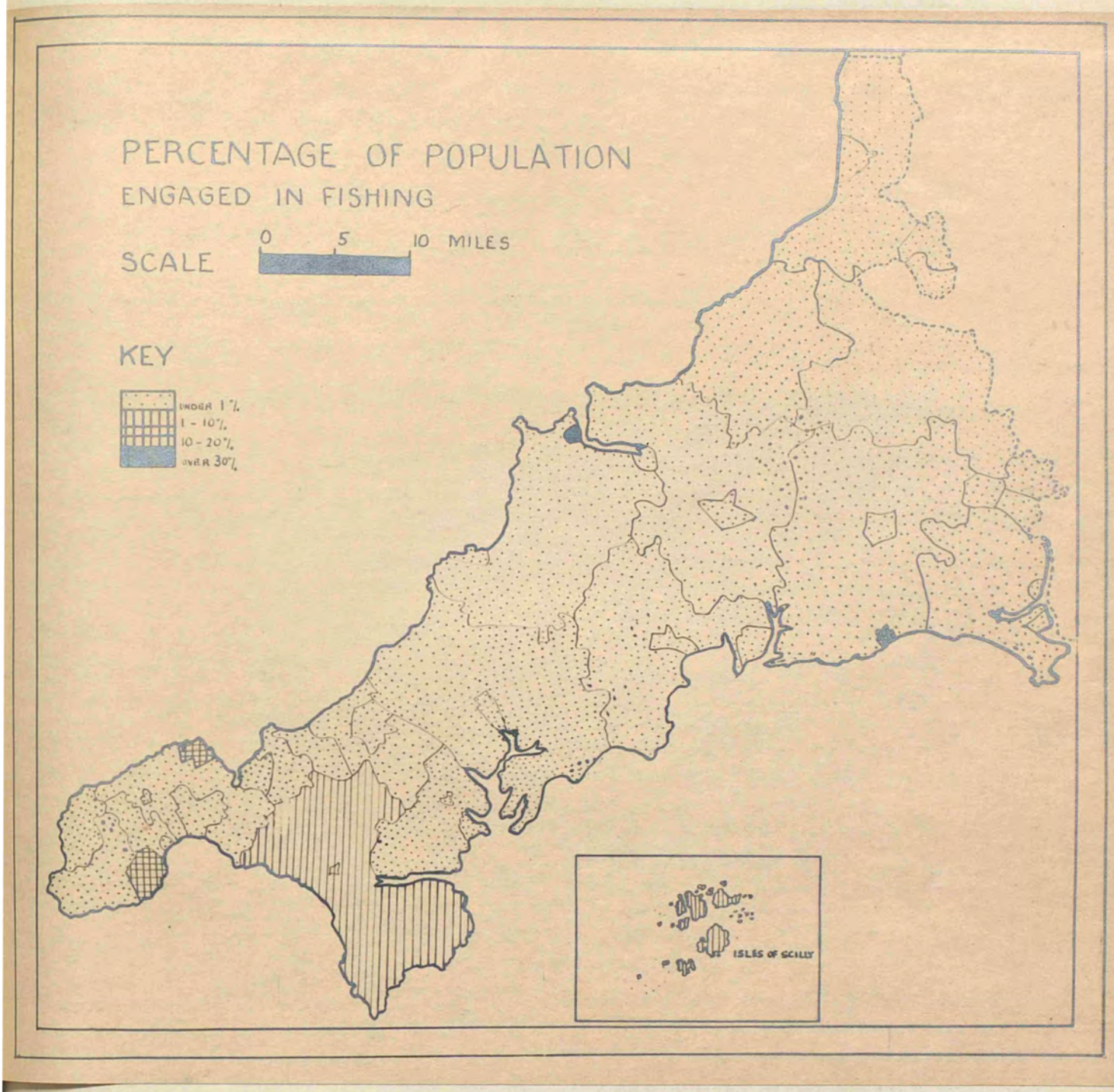


Plate 21. Percentage of Population engaged in Fishing.

some years seemed likely in any case. For 1928 there was an estimated stock on the Truro beds of 5 million young and ½ million large oysters in addition to about 1¾ million on the Falmouth beds. The mouth of the estuary was calculated to have about 6¼ million young and over ½ million large oysters. Results obtained proved the beds in a healthy condition but suffering from overfishing and therefore the limit fixed for the following years was 2 million oysters. With regard to the oyster catch in the British Isles about half the total is produced by the Thames estuary, a large proportion by other East coast areas, and the Fal estuary takes third place in importance.

As regards natural conditions for a healthy oyster fishery most essentials are fulfilled in the Fal estuary. Brackish, clear, water with a firm rock bottom is the ideal habitat. Silted estuaries or the proximity of large towns which discharge refuse are bad. Oysters, like pilchards, are sensitive to any sudden change in salinity, temperature, or clearness of the water.

Analysis of map.

It appears from the most recent available statistics - 1921 Census - that on an average 24 in every 1000 persons in the County, 30 in urban districts and 19 in rural districts, are engaged in fishing. The figures are probably much too low since on the night of the Census many fishermen were at sea and are stated as not included in the returns. Outstanding

areas are the Paul district, St. Ives, Looe, and the Scilly Isles.

The map shows a uniformly spread but low percentage of population engaged in fishing. The Lizard district is the only area which has anything above a very low proportion, excepting Padstow which is the core of the fishing population. This figure is, however, rather high as compared with other stations and it is probable that stations of the west and south-west had a larger proportion of their fleet out on the Census night.

Actual densities

Under 1% grade.

Most of the peninsula.

1 - 10% grade.

Lizard area and Scilly Isles.

10 - 20% grade.

St. Ives and Mousehole districts.

30% grade.

Padstow station only.

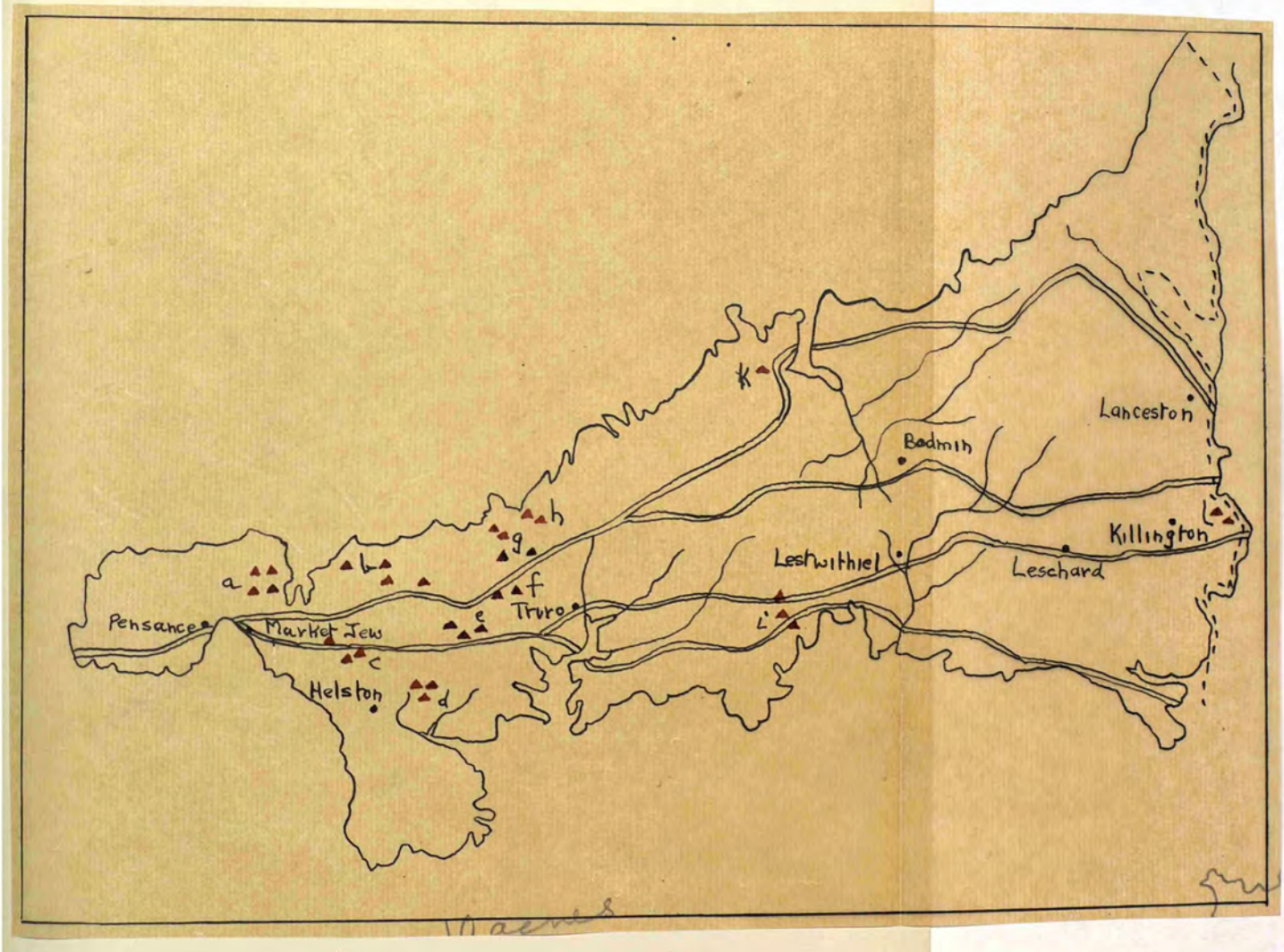


Illustration 33. Old Mining Map after Moll - 1846.

Illustration 33. Cornwall after H.Moll - 1846.

Showing Old Mines.

(a) Tin and Copper Mines called Wheal an Noon, etc.

(b) " " " " " Gwithian, Camborne, Truro.

(c) " " " " " Trevarbus, Wheal an Vor, Godolphin.

(d) Lead Mine called Port le Van.

(e) Tin and Copper Mine called Carn Key.

(f) " " " " " Treved - 100 fath. deep.

(g) Lead Mine called The Garrows.

(h) Tin and Copper Mines called St. Agnes, Pollneve.

(i) Many Tin and Copper Mines.

(k) Ancient Lead Mine - St. Trelay.

(l) Many Tin and Copper Mines.

CHAPTER VI.

Mining and Quarrying Industry.

Mining and quarrying in the west of England are characterised by peculiar products which differentiate the region from other mining areas of England. The antiquity of British tin in the west is undisputed. In later times copper and to a very small extent gold, silver, uranium, and wolfram and arsenic, by-products of tin, have been mined. China clay and granite are the chief quarry products but were worked much later since the industry necessitated the development of good harbours and a satisfactory transport system. Granite and slate were not important until the last century although Carew mentions slate in 1602. The growth of the peculiarly characteristic china clay industry began in the mid 18th century and increased in extent until about 1816. Market conditions have since caused a gradual falling off in the output, although the west of England is still the primary source of supply.

The tin and copper mines are of much greater antiquity and historic interest especially the tin mines. It is an established fact that the Isles of the Cassiterides were visited by trading peoples, Phoenician, Iberian, or Gallic, in 1000 B.C. On very old maps the Cassiterides are supposed to have been where the Scilly Isles now are but these can never have yielded tin so that the name must be extended to

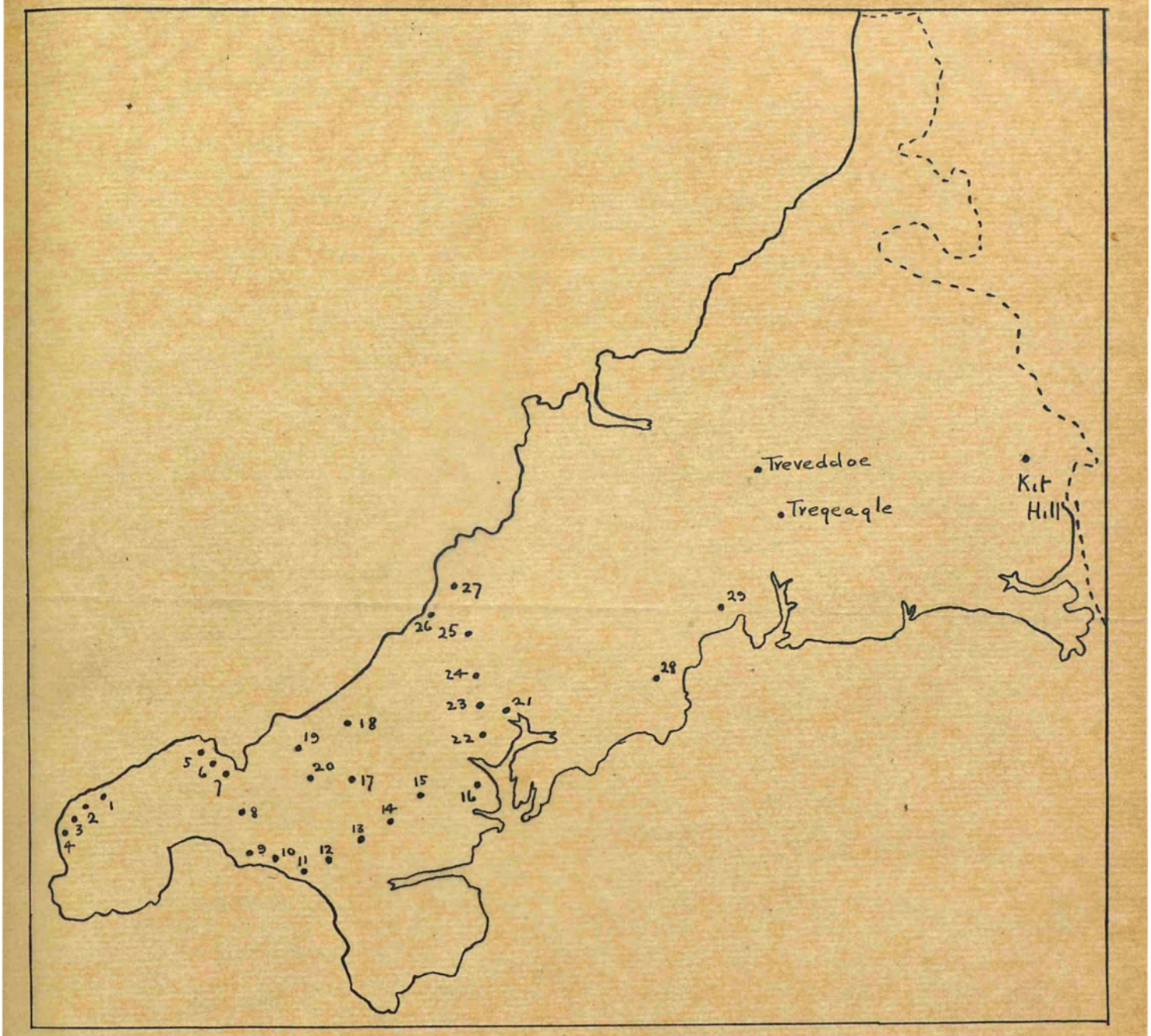


Illustration 34. Modern Mining Map - Penzer - 1921.

Illustration 34. Tin Deposits after Penzer - 1921.

1. Geevor.
2. Levant.
3. Botallack.
4. Porthleddo.
5. Trenwith.
6. St. Ives.
7. Giew.
8. Trencrom.
9. Wheal Hampton.
10. Goldsithney.
11. Lady Gwendolen.
12. Great Work.
13. Wheal Vor.
14. Nancegollen.
15. Boswin.
16. Magdalen.
17. Tresavean.
18. Peevor.
19. Dolcoath.
20. Grenville.
21. Wheal Jane.
22. Gwennap.
23. Poldory.
24. Poldice.
25. Great Wheal Busy.
26. West Kitty.
27. Wheal Kitty.
28. Kingston Down.
29. Tregnonon.

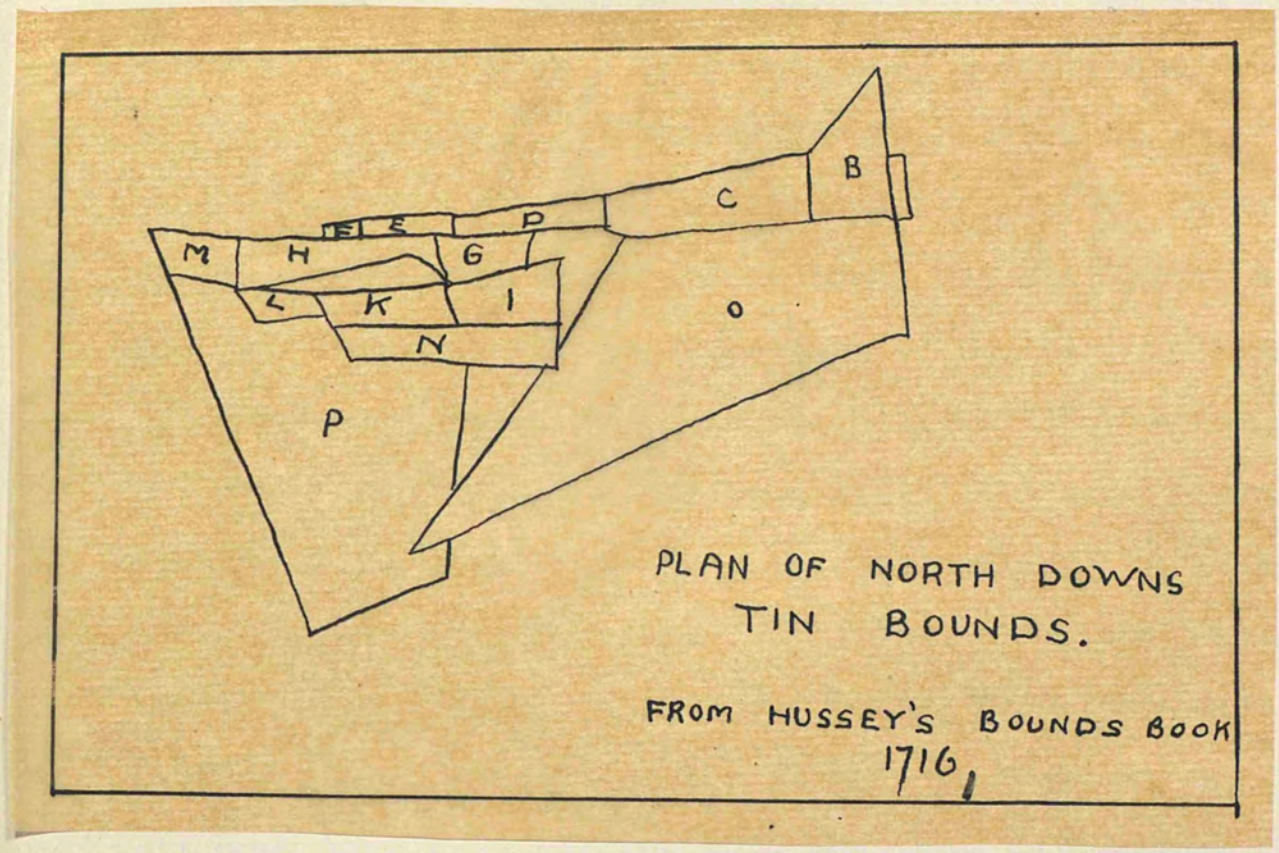


Illustration 35. Diagram of Tin Bounds.

the mainland peninsula. This is the Bolerium of Diodorous Siculus who describes the inhabitants as hospitable and civilised. They produced tin which they carried to Iktis, (St. Michael's Mount) an island at high tide. From there it was taken to Gaul by traders on horseback who reached Marseilles in 30 days. In Roman times there are no records but it is probable that the Romans worked tin in addition to lead. Relics of circular earthworks are thought to be Roman trading posts and several round mines are attributed to the Romans. Cornwall was the last part of southern England to be subdued and remained an independent Celtic community until 937 when conquered by Athelstan. With the Saxons began the system of the stannaries which was to continue until the 19th century. The Saxons of the 17th century carried tin to the fairs of France. During the Middle Ages records are lacking and no mention of tin is made in Domesday Book, although lead and iron are both mentioned. The fact that tin was at some period considered a royal property and therefore not taxed may account for this. Authentic Cornish mining history may be taken to begin in 1156 when brief entries are recorded in the Pipe Rolls which chiefly relate to west Devon only however. Since then the industry has gradually moved westward to the limits of the peninsula. In 1163 133 thousand weight (1200 lbs.) was produced which had increased by 1171 to 640 thousand weight. About this time some light is thrown on the condition of the miners by various

authorities. They are compared to the villeins of Feudal Days but had certain priveleges of bounding or prospecting anywhere, could stake out a claim, and were generally much more favoured than workers in coal mining areas. In 1198 a warden was chosen by the King to convene juries of miners from the two Shiremoots. There was then no definite stannary system. By 1200 the output had risen to about 800 thousand weight. The Stannaries Charter of 1201 inaugurated a new system under which miners had special stannary laws and courts and were accorded privileges of bounding in addition to fuel and water rights. In the next 14 years the output had risen to 1200 thousand weight. Of the 13th century there is little evidence. By 1300 all former regulations had disappeared. The new Stannaries Charter of 1305 gave the two counties separate Stannary Courts which lasted until a century ago, and which further defined the right of bounding. By 1495 at least four stannaries were outlined, but never defined. These were Foweymore, Blackmore, Tywarnhail, and Penwith. From the 16th century to the 18th century convocations of tinners were called together to decide questions of the workers. In the early 17th century the stannary jurisdiction covered all workings in black tin. Each stannary had a steward under the warden and its own court and coinage town as at Helston, Truro, Lostwithiel, and Liskeard. By this system the tinners were excluded from all but stannary laws and courts. In the early days the Cornish tinners had a stannary court on

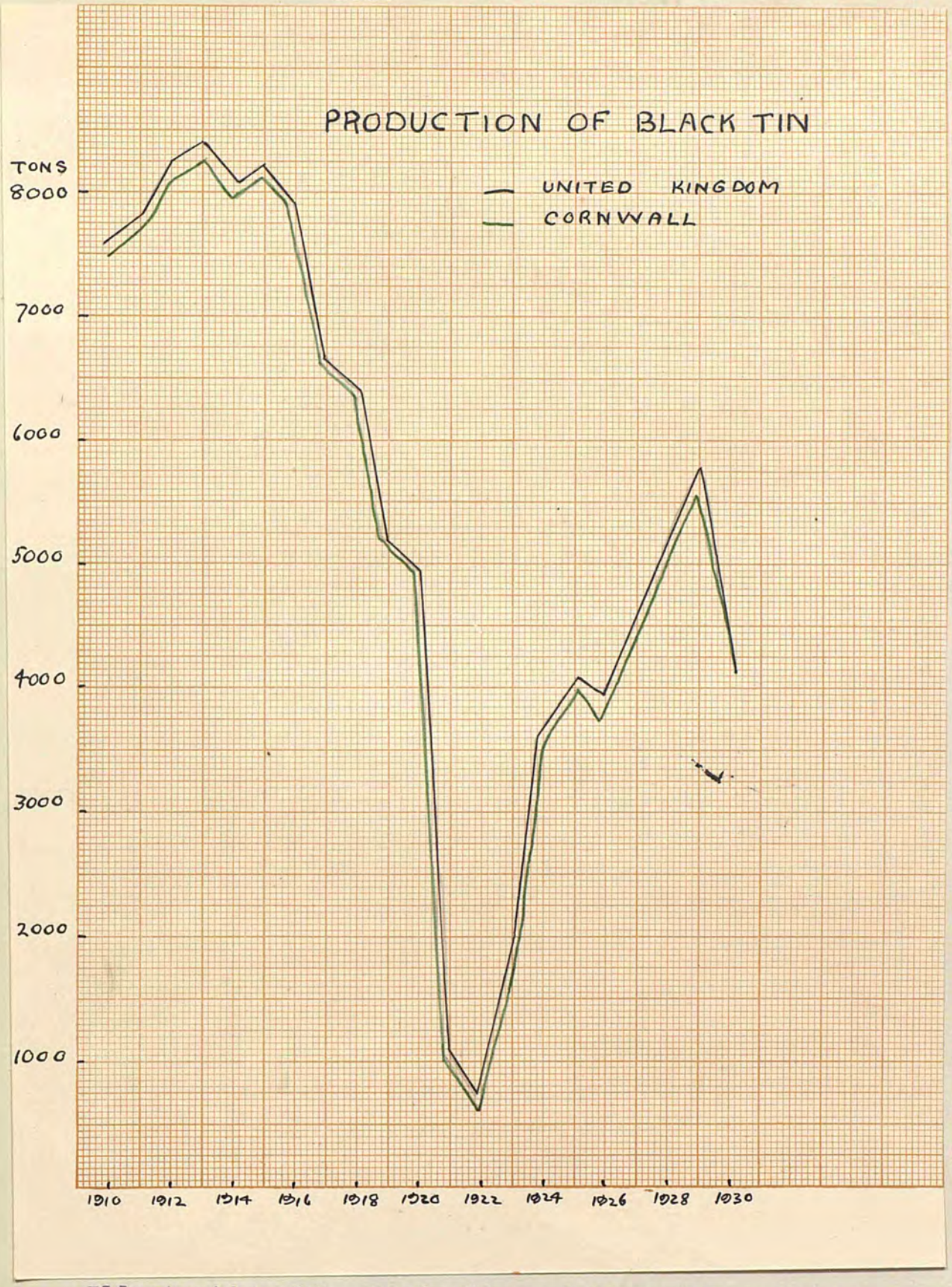


Illustration 36. Production of Black Tin - United Kingdom and Cornwall.

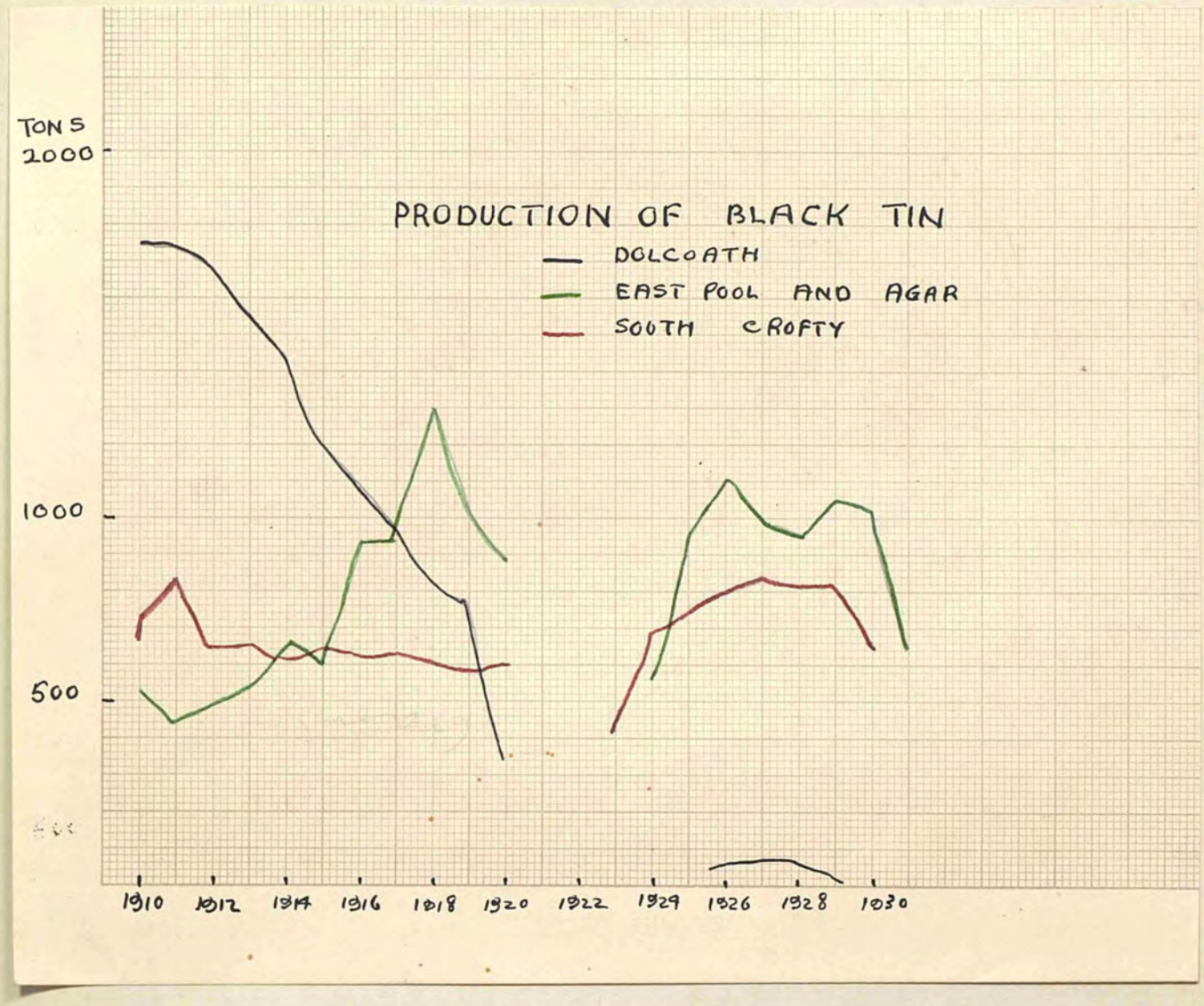


Illustration 37. Production of Black Tin at Chief Mines.

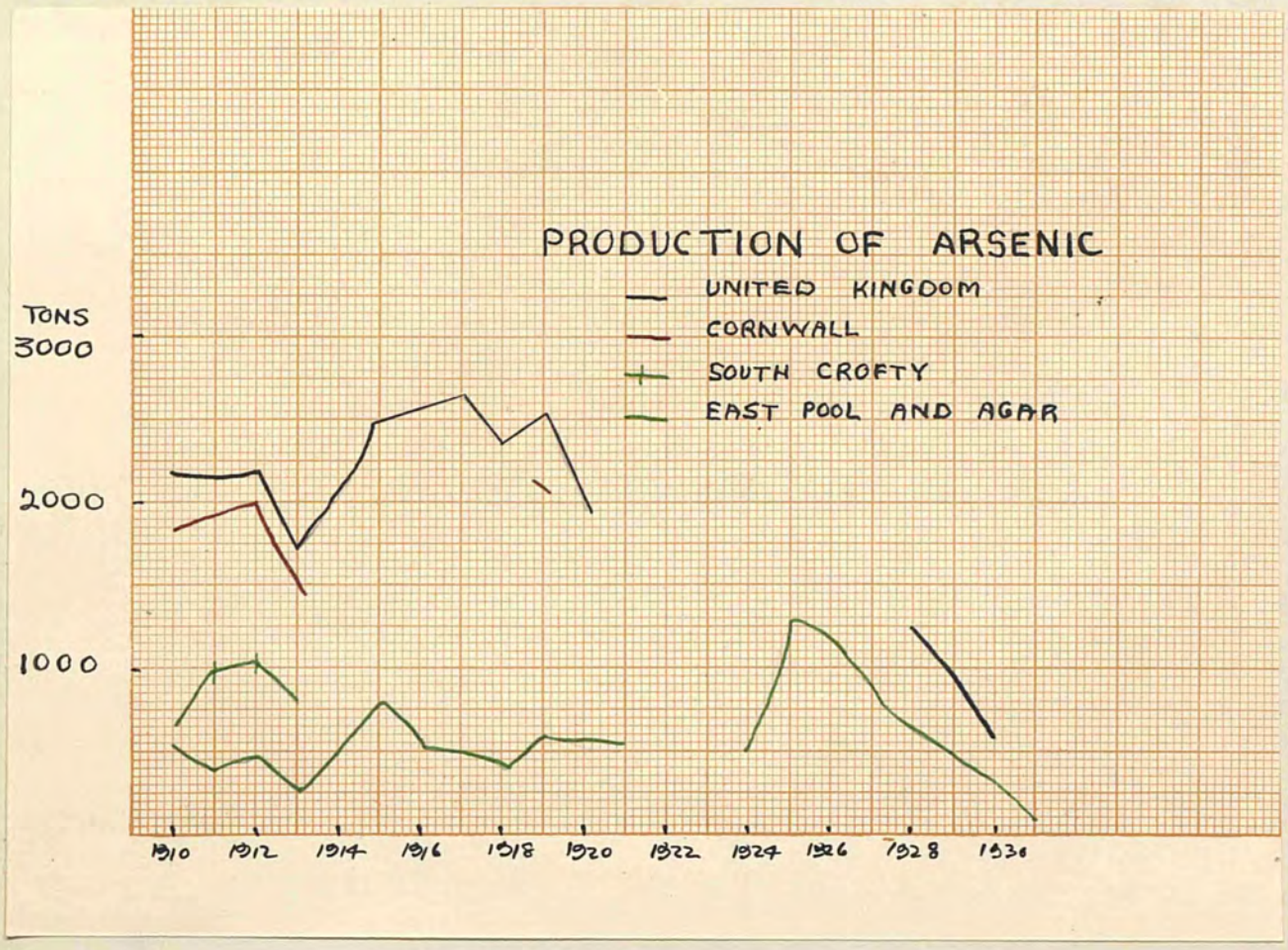


Illustration 38. Production of Arsenic.

Caradon Hill. These stannary courts were like the Medieval Trade Guilds. Each stannary town had its own council of six. Unlike the Medieval Guilds however the Stannary Parliaments persisted and were much less exclusive and more like a gradual development of capitalism which survived in the cost book companies and corporations of later centuries.

Tin Mining. is of vital importance to the West of England and more especially to Cornwall. In the past the Cornish mines were training grounds for the pioneers who emigrated to new lands and there developed vast resources of gold, copper and other metals. The present position is bad but largely on account of economic difficulties, and the future may bring again prosperity since the mines are in every case deep and not worked out. Energy, enterprise and capital could do much for the tin mines of Cornwall.

Generally the tin zone occurs below the copper and copper,- tin,- wolfram, zones. In this respect the East Pool Mine shows the zoning very clearly - the wolfram zone is intermediate between the tin and copper zones. The conditions of working and quality of ore varies from district to district. Usually the tin lodes penetrate the granite in Cornwall and the copper lodes the killas. There are actually three tin producing districts but of these the Camborne district produces 95% of the county total. The Bodmin area is much less important and the Lands End area was never worked continuously. The average metallic content of the ore mined

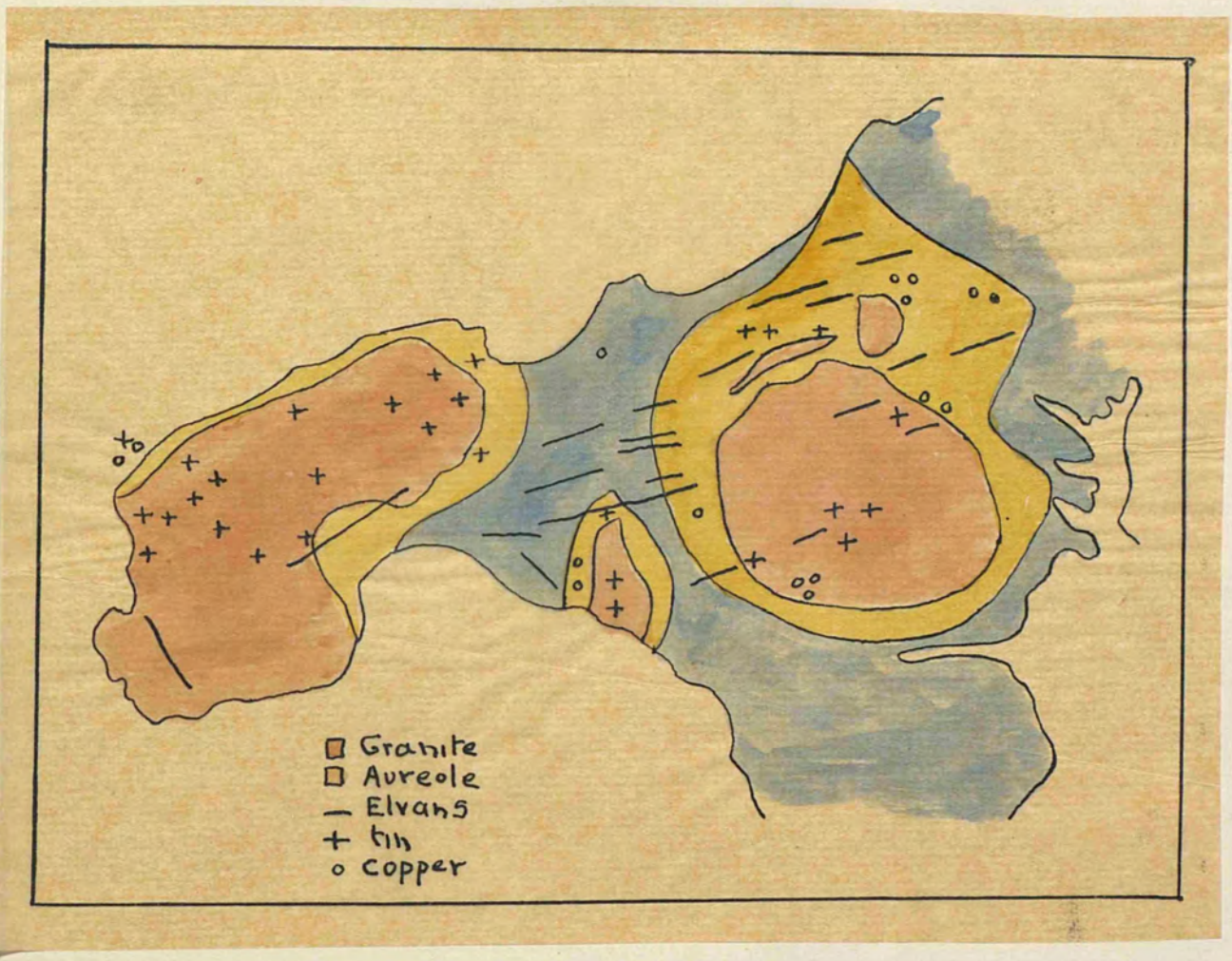


Illustration 39. Extent of Metamorphic Aureole, from Jones - Tinfields of the World.

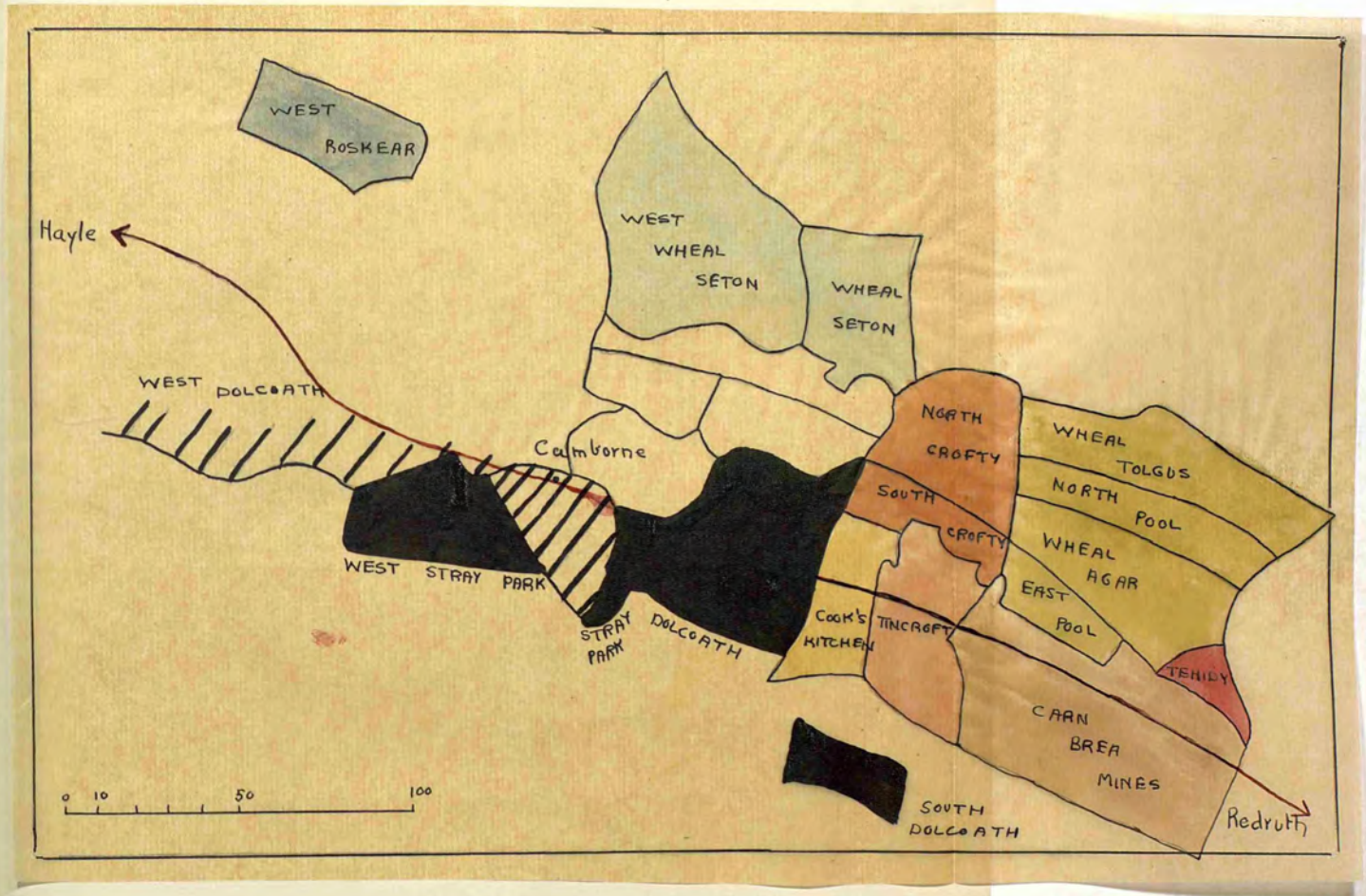
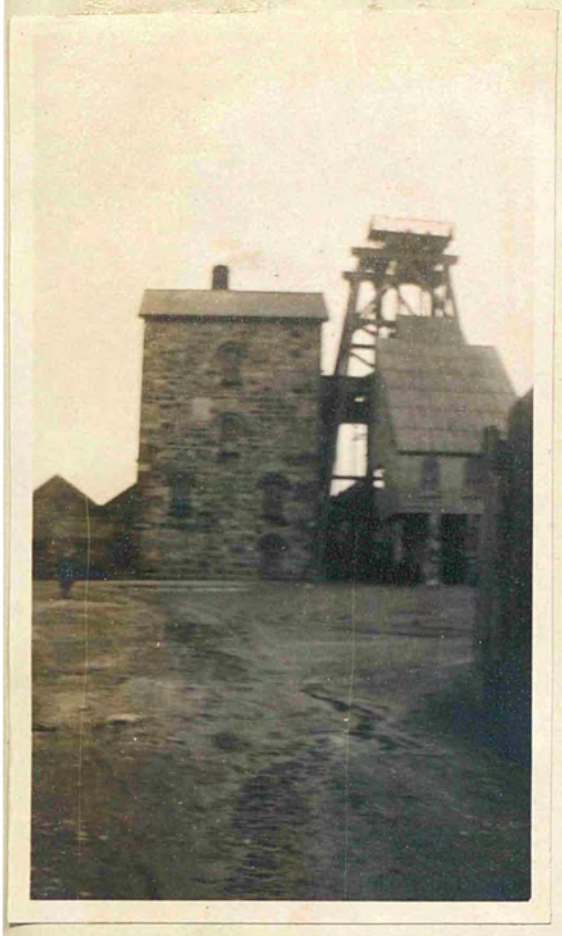


Illustration 40. Mine "Setts" of Camborne area, from Symons - Map of West Cornwall Mining District.



East Pool Mine
Shaft, 1931.

Alluvial Tin.

East Pool Mill - 2 miles distant.

The St.Just
area -
ancient mine
stacks.

is about 78.6%. Tinstone or cassiterite is the chief ore but oxide of iron and tin oxide are sometimes found. Following on the granitic intrusions of late carboniferous times the tin and copper lodes were formed by emanations through fissures with the strike in the direction E.N.E. - W.S.W. The strike of the lead and silver lodes is N. - S. and these came later. Within the metamorphic aureole the lodes are much crowded. The lodes of the Lands End district occur in isolated groups; in the Camborne district they are packed into a narrow belt of shales along Carn Brea and Carn Marth. Fissuring is not general since ore deposits are lacking beneath the Lands End granite and also because the angle is very important since a high dip means a narrow belt at the surface. Mines are found at intervals along each lode zone. Dolcoath mine shows a zone of copper down to 1000 feet below the tin. The Bodmin area shows lodes at its south-eastern margin but these are largely copper. There is, however, a considerable amount of stream tin. The extreme west has two centres - St. Just where narrow fissures are worked beneath the sea and Levant where the best tin zone occurs at about 500 fathoms west of the coast and between 278 and 350 feet in depth. The Botallack Mine of this region is very old.

With regard to individual mines it is clear from the graphs showing statistics of output that the following mines produced a relatively high but very fluctuating total output

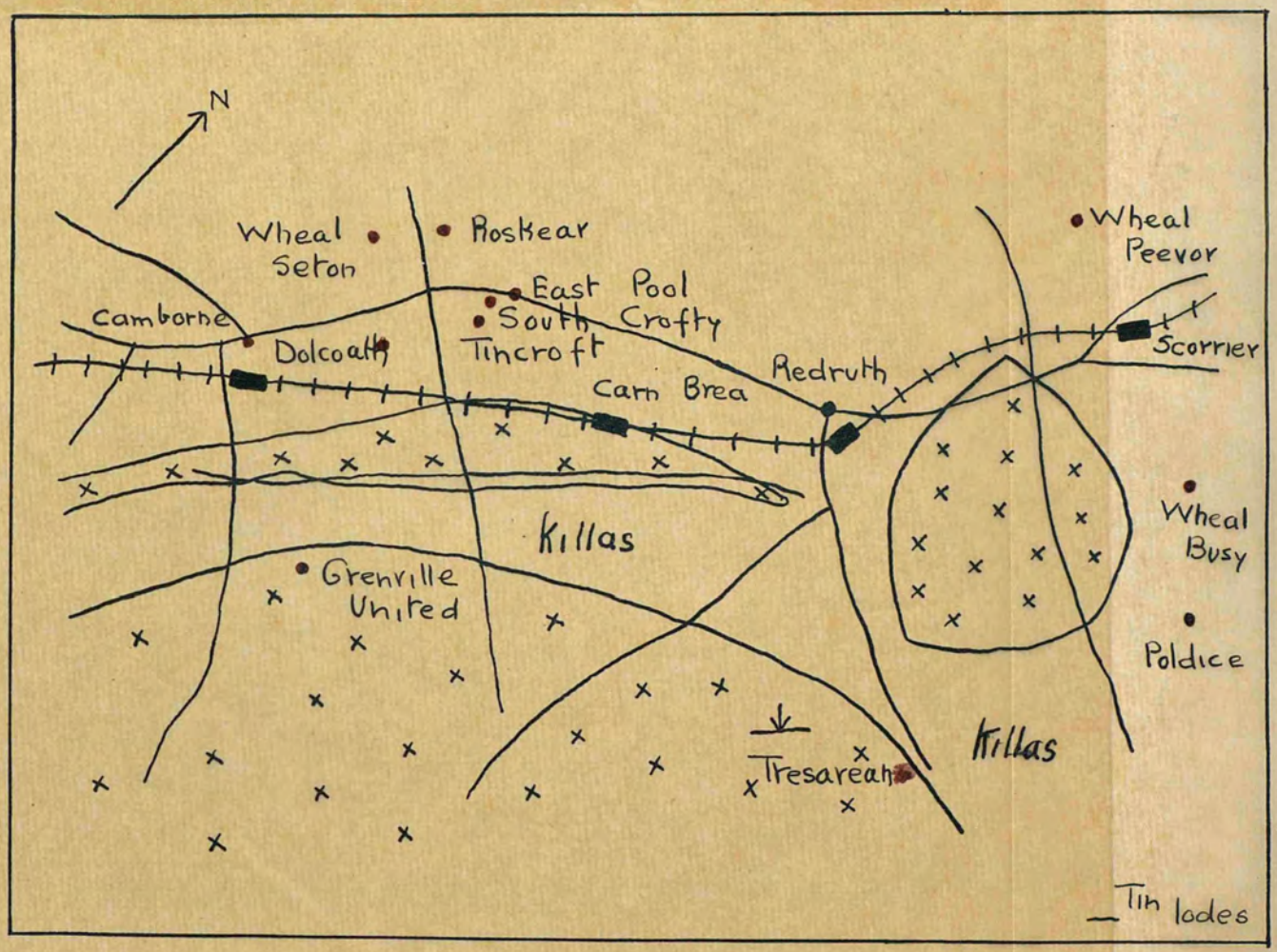
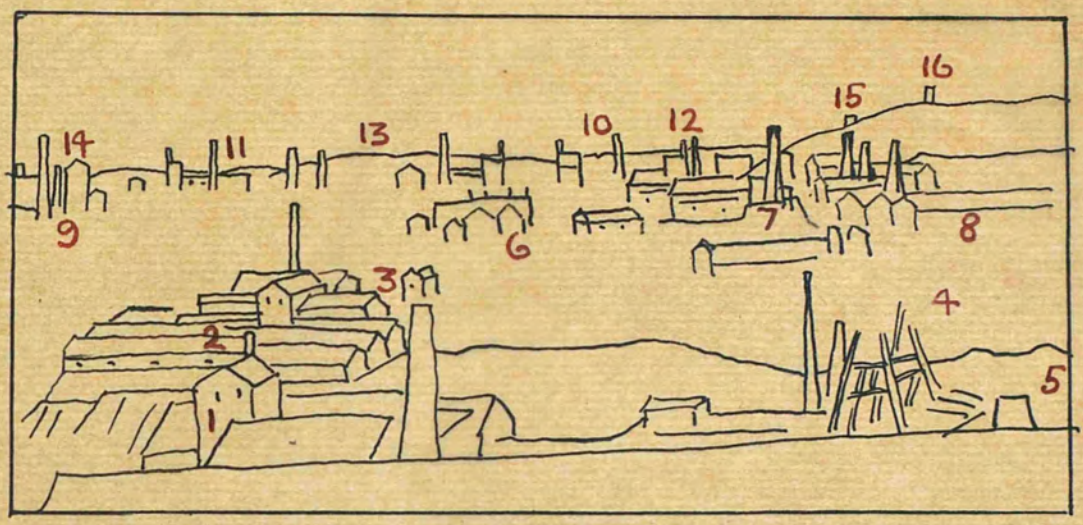


Illustration 42. Diagram of Central Mining Area from Penzer - Tin Resources of British Empire.



THE CHIEF MINING DISTRICT OF CORNWALL

FROM THOMAS AND BURROWS 'MINES AND MINERS'.

Illustration 41. Chief Mining District after Burrows.

1. Old stamp engine at Dolcoath.
2. New Californian stamps.
3. Pumping shaft.
4. Dolcoath East Shaft.
5. Dolcoath valley Smithy.
6. Cook's kitchen "count house".
7. Cook's kitchen pump and winding engine.
8. Cook's kitchen stamps and dressing floors.
9. New Cook's kitchen mine.
10. Tincroft new pumping engine.
11. North part of new mine.
12. Carn Brea Mine - South.
13. Carn Brea Mine - North.
14. East Pool.
15. Carn Brea Castle.
16. Carn Brea Monument.

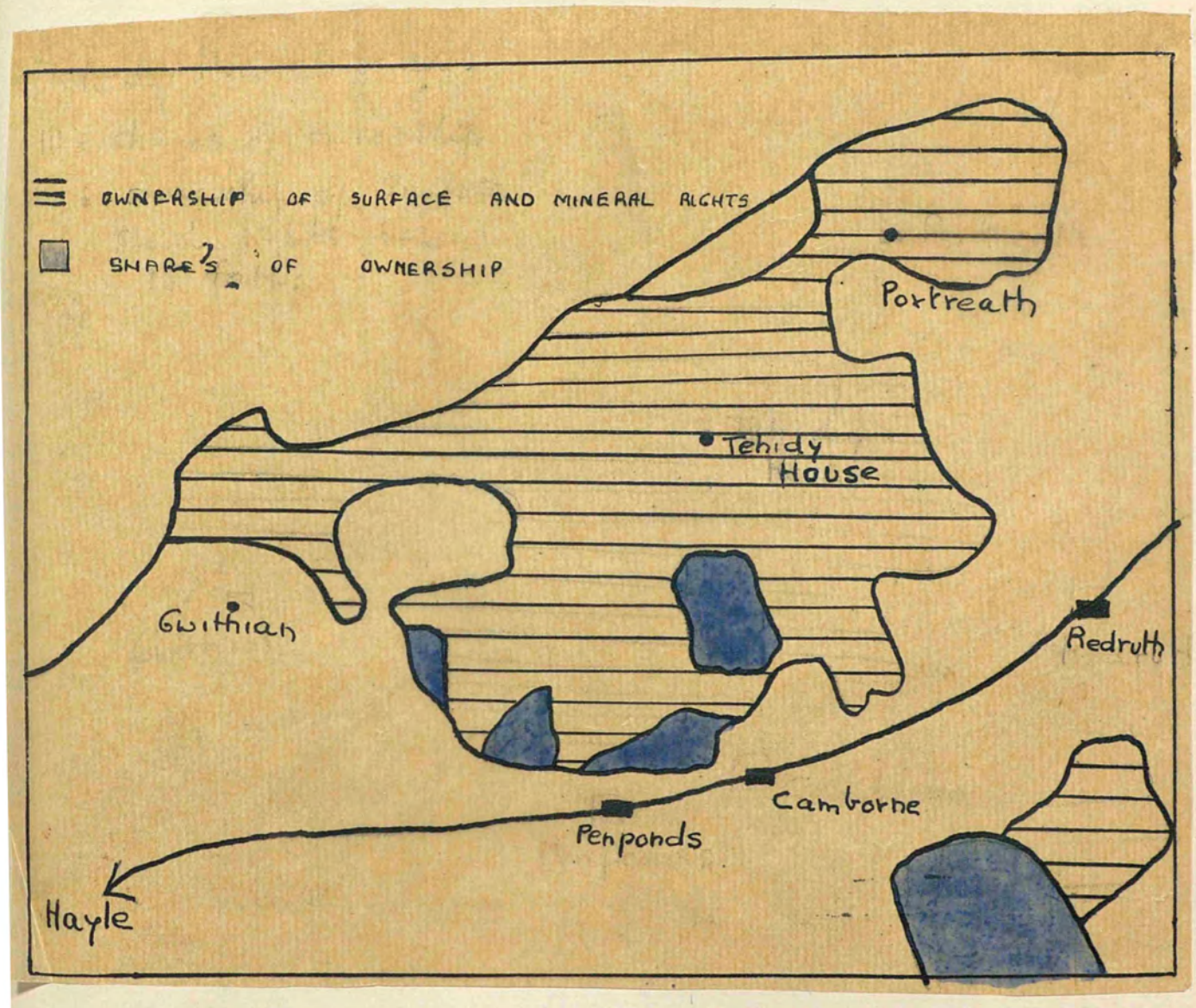


Illustration 43. Diagram of Tehidy Minerals.

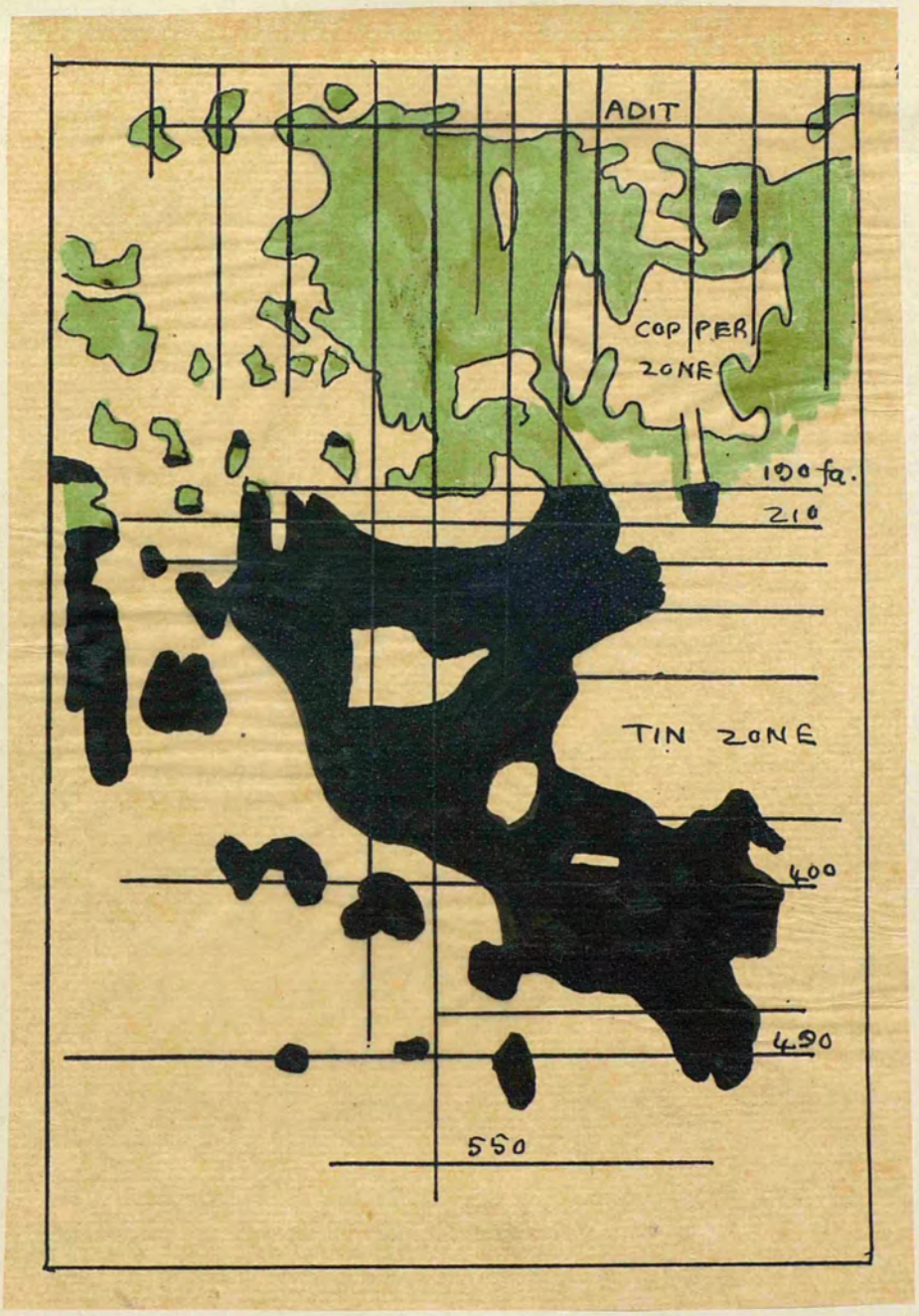


Illustration 44. Section of Dolcoath Main Lode.

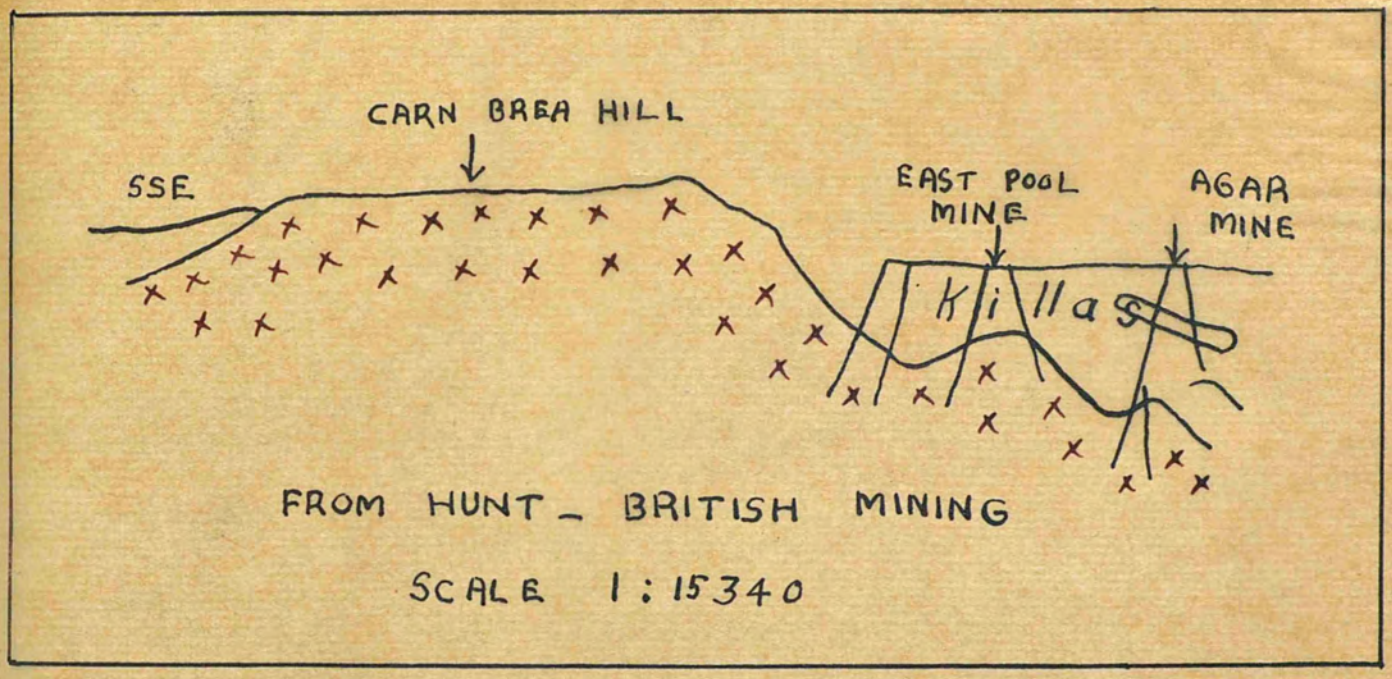


Illustration 45. Site of East Pool Mine.

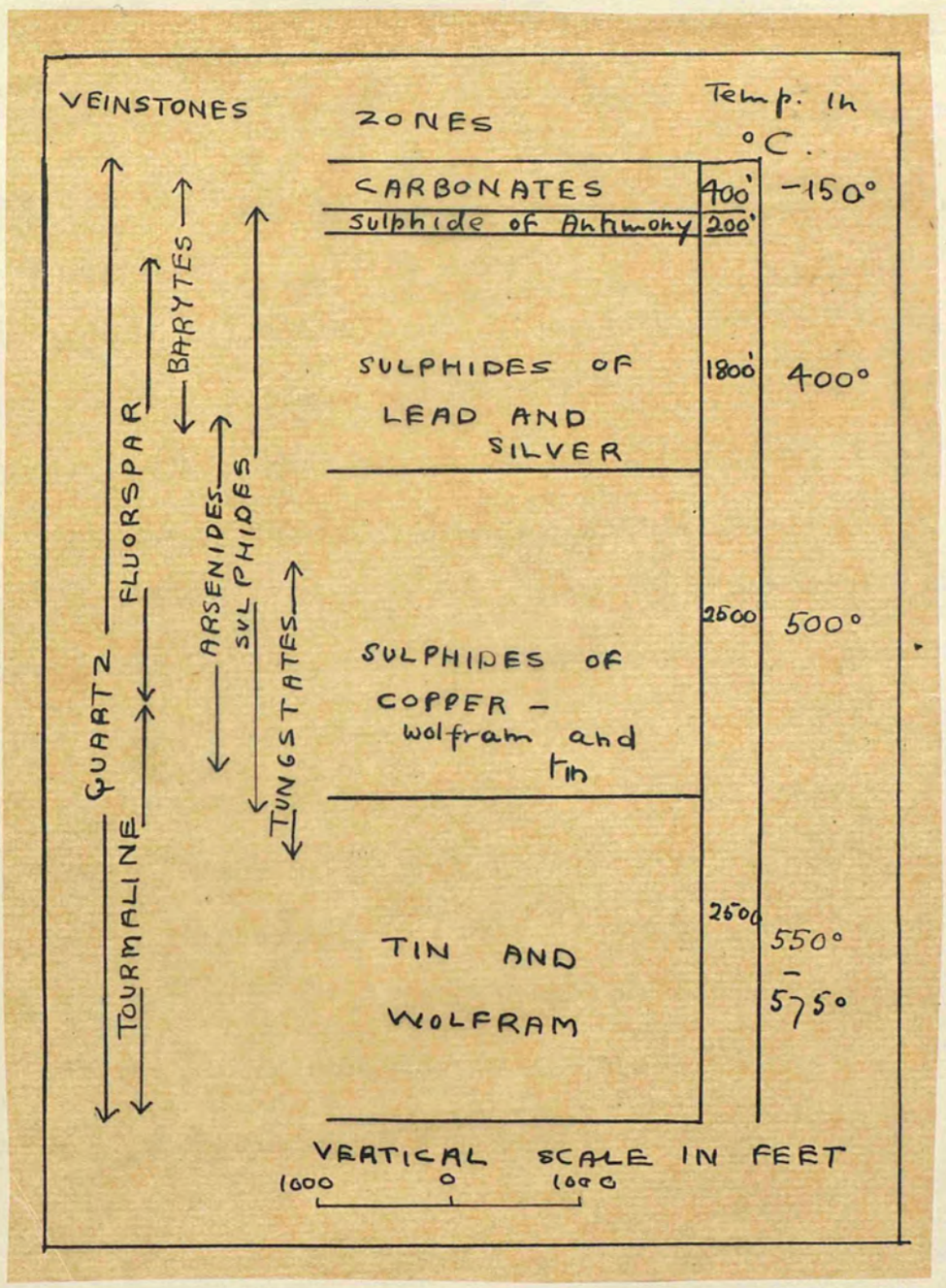


Illustration 46. Mineral Zones after Mantell.

from year to year -

Dolcoath, East Pool and Agar, South Crofty.

Dolcoath has now fallen to the bottom of the list but has had a long and active life. It is not now believed to be exhausted, but lacks capital for new developments. In 1788 the mine appears to have been working but has had a phenomenal rise since 1867. The mine now includes several old mines and the section has been worked for over a century and a half. Development is thought possible in areas situated to the west and north.

The East Pool mine is at present the most likely to succeed and development is looked for in an area to the north of the Roskear section. It was in 1931 the only tin mine working. South Crofty continued pumping but had suspended all mining operations. East Pool mine was working only 2 days per week which supplied the mill throughout the week by working on day shifts only. Modern equipment is in evidence at East Pool and wasteful methods are not used. This mine alone appears to be in a healthy state.

With regard to copper mining the maximum development was reached at about the middle of the last century but has since declined. Famous old copper mines are now exhausted and copper at present is only mined in connection with tin. It occurs as sulphides, oxides, carbonates, and has recently been found with tin ore as chalcopyrite. In the 19th century about half the world production was found in Devon and Cornwall. As the mines

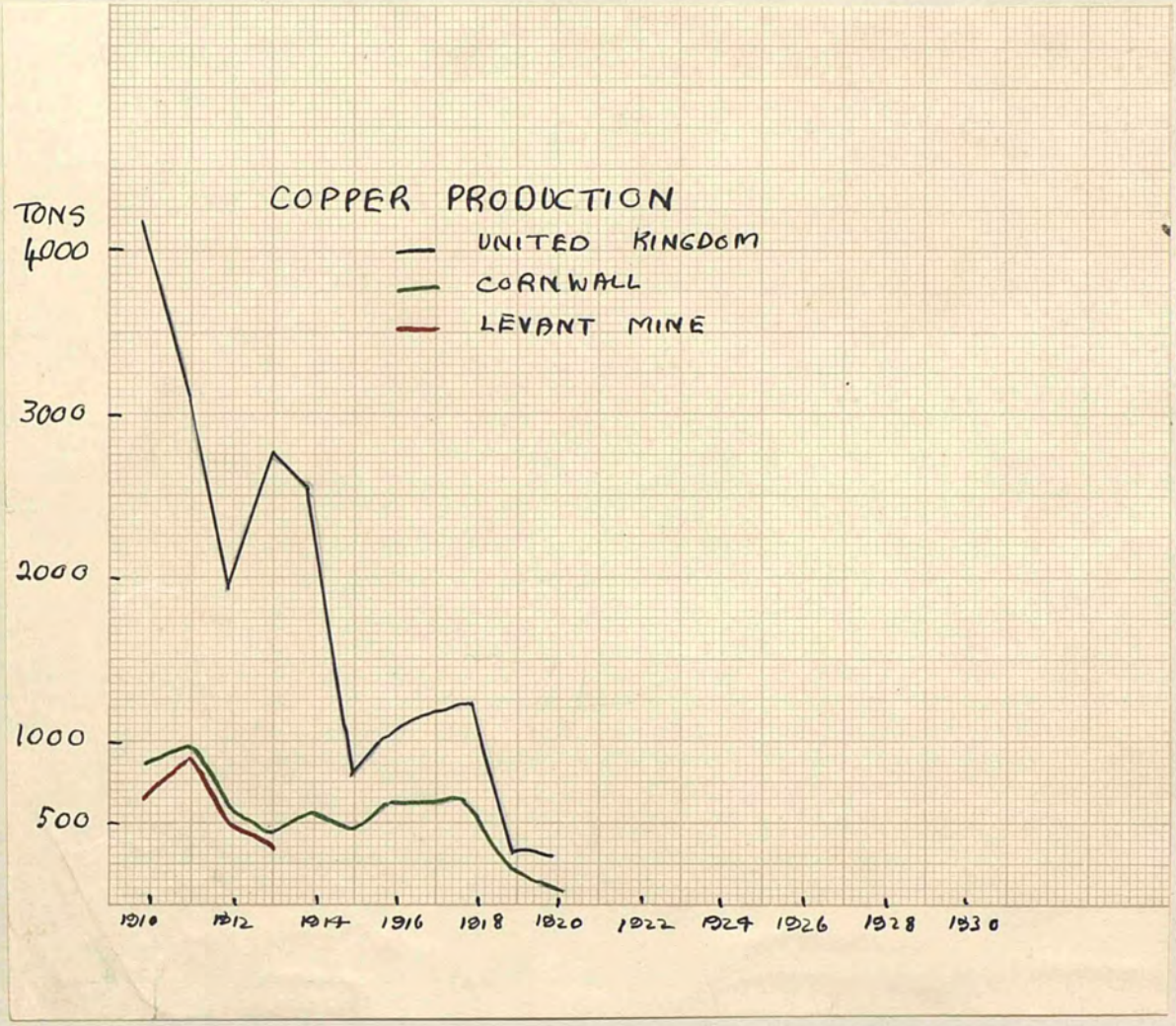


Illustration 47. Copper Production.

deepened, however, the richest zone was passed through. Of the various ores rich grey ore was formerly found at St.Just, Breage, and St. Austell. On Caradon Hill oxides and carbonates occur. The Gwennap area has a rather cindery type of ore. All these types are probably derived from chalcopyrite.

Copper, however, is not found at all the mines. There are five important areas - the St. Just area where the Levant mine is the chief, the St. Ives area, the St. Austell area, the Caradon and Kit Hill areas.

Zoning is again apparent and there are generally three zones - zone of oxidised ores, zone of sulphide enrichment, zone of primary sulphides. Copper pyrites is also abundant and"gossan" or iron hat is found. The original ores are leached by atmospheric waters, the copper is dissolved when sulphates or chlorides occur. The argillaceous slate area is the most productive and there is general enrichment in the neighbourhood of elvan dykes. Ore has been found in the greenstones and granite areas. Tin ore is situated nearer the backbone of the peninsula and copper further away. The granite areas produce tin only. It is interesting that at the Botallack mine one lode passes three times from the granite to the slate and at every change when in the granite area tin only occurs.

Taking each area the St. Just area is the most interesting as regards copper mining. There is merely a narrow coastal strip of about 4 miles beneath which are many lodes

and floors.

Mineralisation is closely connected with earth movements. Levant, Botallack, and Mellanear are the chief mines. At Levant mine iron ore and copper have been found in the upper levels and tin and arsenic below. The walls being intensely hard special stoping has been necessary. The copper region extends about 1¼ miles from the coast at a depth of about 360 fathoms. The ore raised is 60% metallic copper.

Regarding the copper mines of the Central Mining area situated in the neighbourhood of Camborne little has been written. It is known, however, that at Perranzabuloe, St. Agnes, Dolcoath, the Seton mines, East Pool, Tincroft, Basset, Thesavean, and Gwennap mines, copper occurs to some extent. At the East Pool mine copper extends to 140 fathoms. The ore is about 14% metal only but all lodes bear copper ores to some extent. At South Crofty copper is found in the killas. Dolcoath is rich in copper especially in the Stray Park section and is not confined only to the killas. The copper zone is 190 fathoms deep. In the St. Austell area copper is mined at Fowey Consols, East Crinnis, and Pembroke mines.

The Carradon area is a small area of about 9 square miles south-east of Bodmin in which are situated at least 10 important copper mines. The East Cornwall district is continued into Devon near Tavistock but 3 mines are situated in Cornwall. In addition to these chief mines within each area there are numerous small mines for which no details are

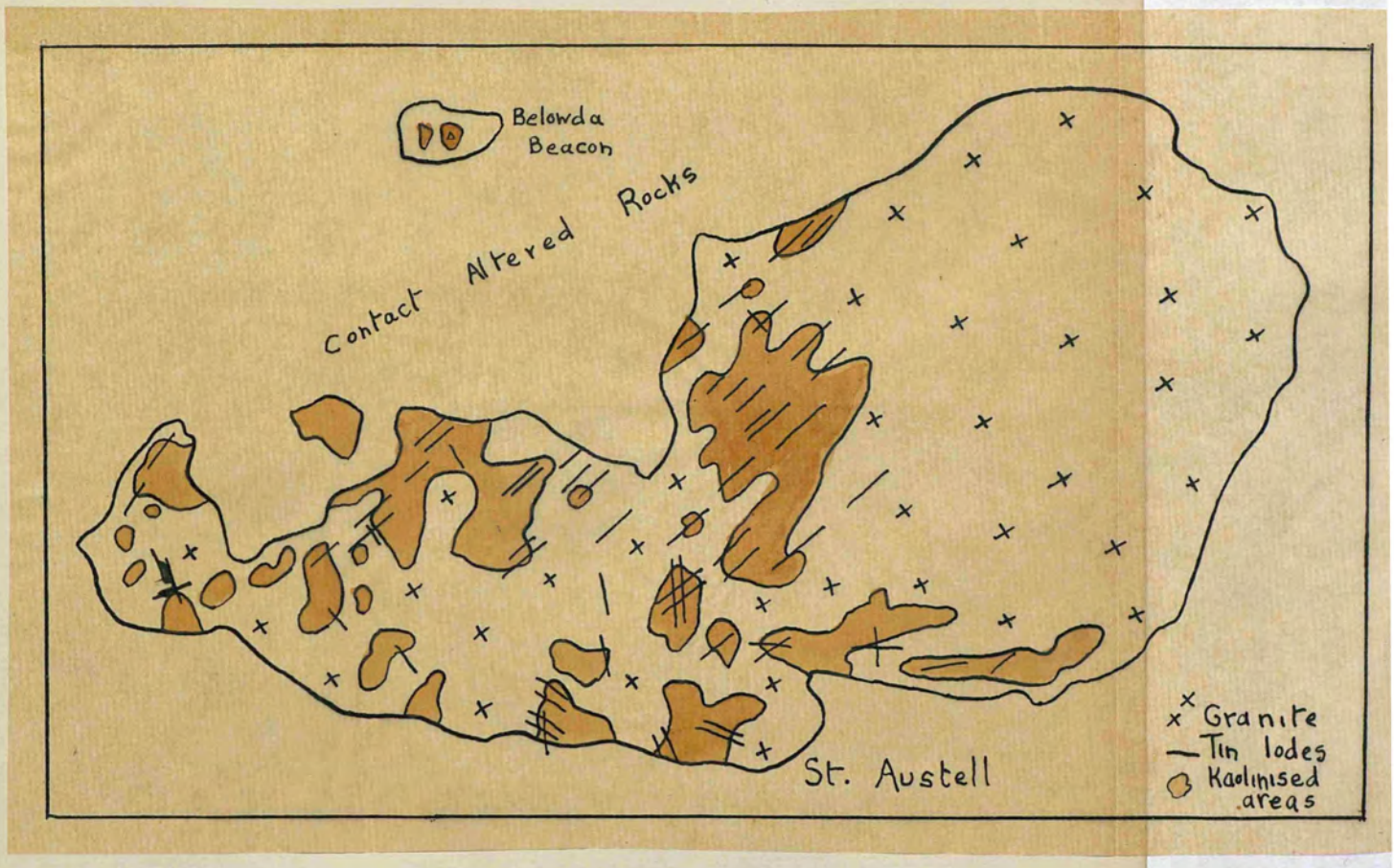
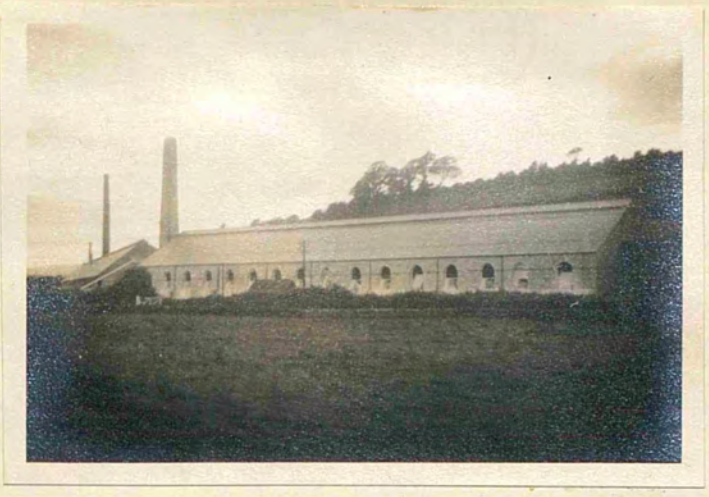


Illustration 48. Kaolinised Area.

A quarry in Hensbarrow area showing "overburden" removed.

Hensbarrow area showing kaolin "overburden" dumps.

No. 8 jetty at Fowey, 1931 in process of completion.



China clay kiln
near St. Austell.

Interior showing
stored clay.

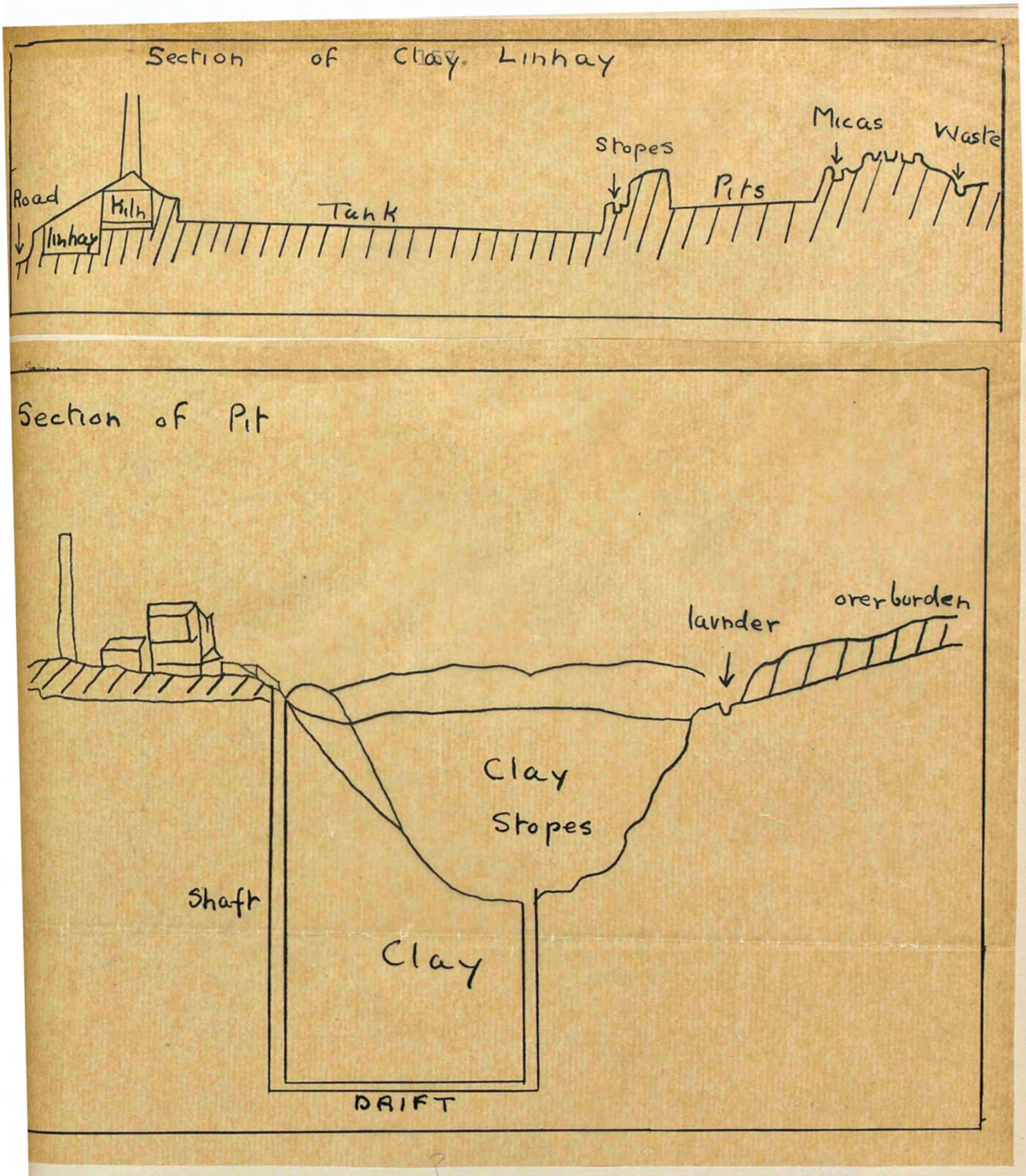
Tank behind kiln.

available and many where development may begin in the future. It has not been shown that these copper mines mentioned, however, have been in any way exhausted and new areas may yet prove productive.

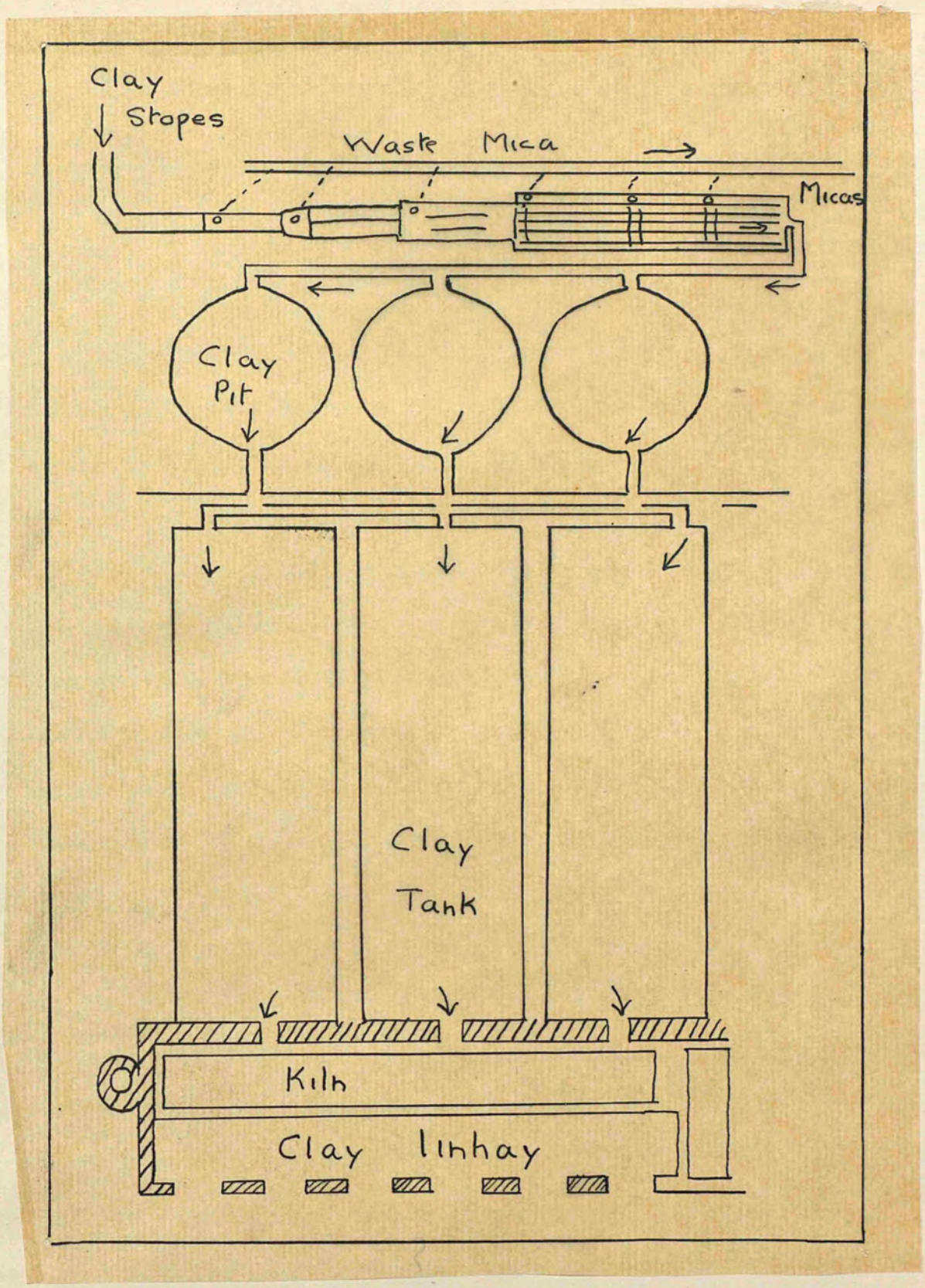
The China Clay industry is even more a peculiar one of the region and although in no more prosperous condition at present yet may be developed in the near future when the depression in trade improves. Greater development is possible and indeed had started but was checked by world conditions. Consequently at present no clay is being mined since large stocks have accumulated in the stores. It is, however, significant that a new jetty with modern equipment has been constructed at Fowey up the river beyond the old No. 7 Jetty exclusively for the handling of china clay and stone.

The Cornish deposit has still many advantages over other areas as regards facilities for quarrying and handling. Competing areas are chiefly China and Saxony but Cornwall has almost a monopoly.

With regard to its occurrence it is easily quarried over a wide area extending around the districts of St. Austell, St. Blazey, Luxulyan, Roche, St. Denys, St. Enoder and St. Stephen. As far back as 1813 there were 7 beds worked in this area, which is to-day by far the most important. The largest bed then shipped about 300 tons of clay per annum. The clay here is widely spread, easily quarried and there are great reserves. It occurs on a smaller scale in patches in all the



Illustrations 49 and 50. Diagrams showing movement of Kaolin from Pits to Kiln.



Illustrations 49 and 50. Diagrams showing movement of Kaolin from Pits to Kiln.

other granite bosses except Carn Menellis. Also in numerous streams it is found to be alluvial.

Kaolinisation as stated in Chapter I is probably due to a chemical change which robs the felspar and mica of potash. Weathering may also have some effect but this appears to be of a subsidiary nature only. The action which takes place seems to be due to variations of temperature and the expansion of water in pores of the rock.

Facilities for transport and handling of the products quarried are excellent in the neighbourhood of St. Austell and the Fowey valley. Mineral lines across Hensbarrow connect the quarry area with the port of Fowey. Access is also easy to the other points of shipment at Par and Charleston which is the chief port for china clay. Fowey has a good harbour and modern facilities for loading cargo including an arrangement of gravitation.from the trucks and a combination of gravitation and electrical hoists. The largest total tonnage handled was in the year 1929 which was a record year for the port and the largest cargo shipped was in a Japanese ship. About 100 ships on an average called at the port per month within the year. There was throughout a floating population of about 14,000 and the number employed at the jetties was about 300.

The following figures are interesting:-

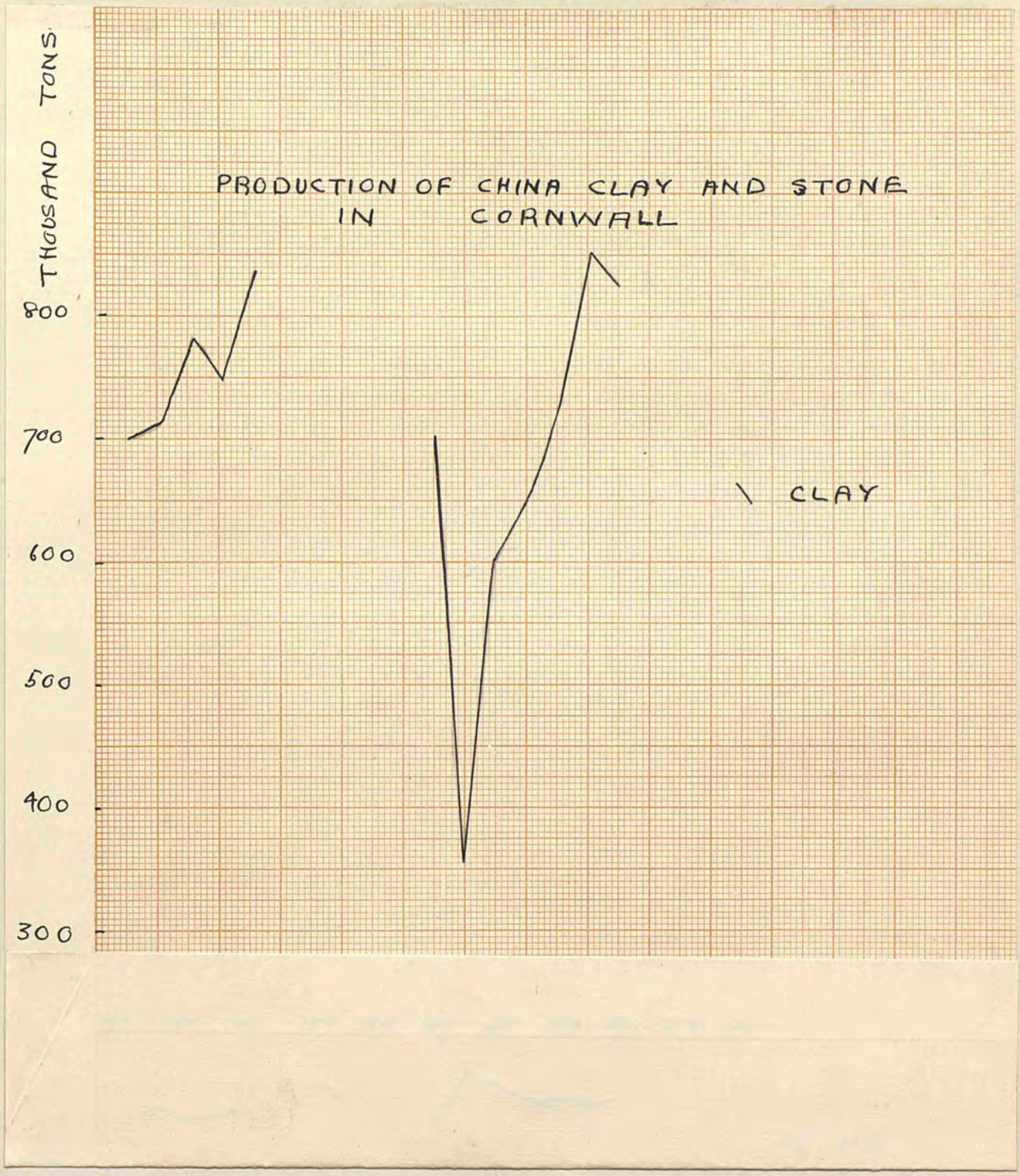
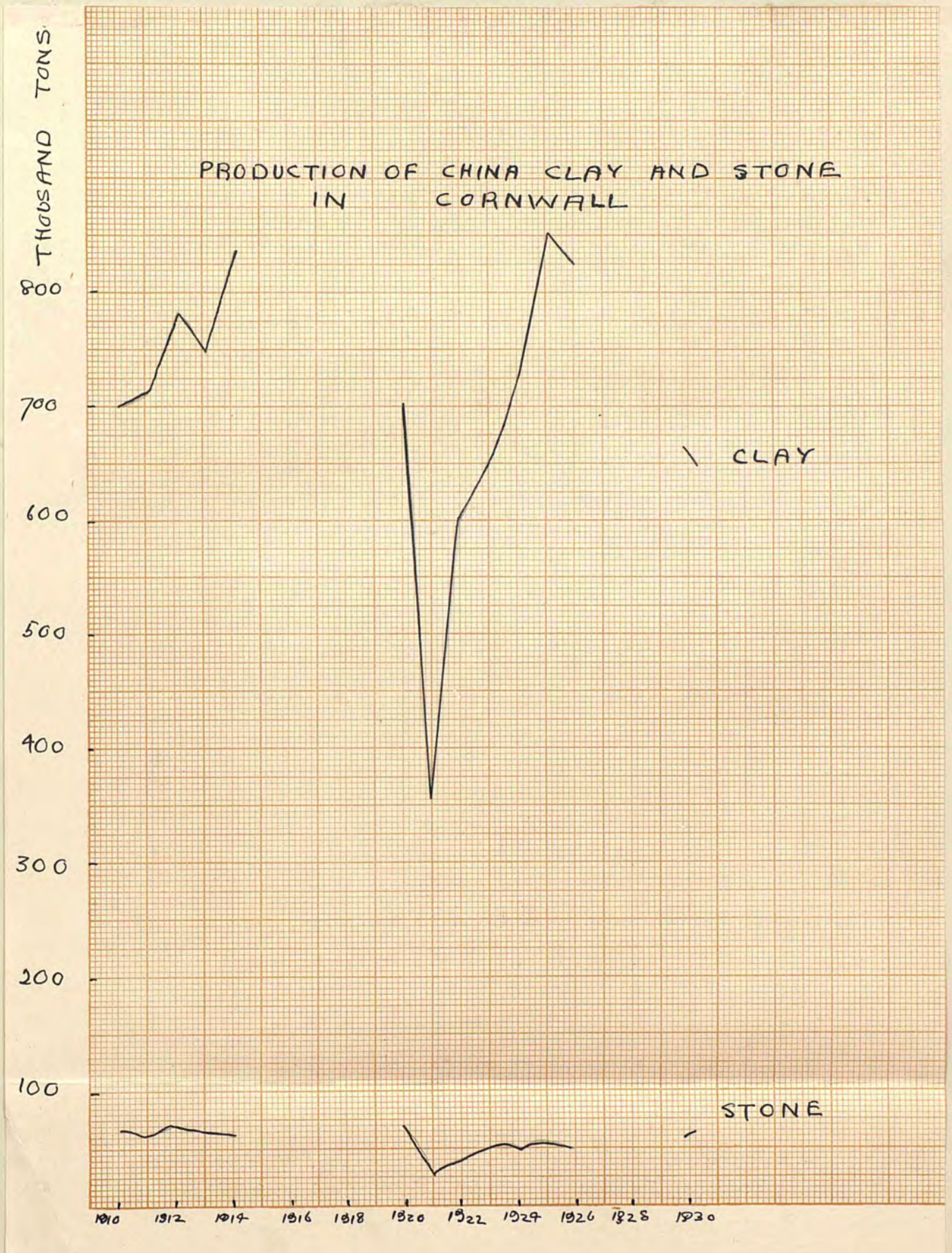


Illustration 51. China Clay Production.


PRODUCTION OF CHINA CLAY AND STONE
IN CORNWALL
THOUSAND TONS
800
700
600
500
400
300
200
100
CLAY
STONE
1910
1912
1914
1916
1918
1920
1922
1924
1926
1928
1930

Total tonnage handled -

1926	.....	759,467 tons	
1927	.....	786,048 "	
1928	.....	783,062 "	
1929	.....	815,880 "	Record for the port.
1930	.....	683,447 "	
		3,827,904 "	total

Average 765,580 tons 16 cwts.

The production in 1904 was 515,451 tons of clay and 66,994 of stone making a total of 582,445 tons.

Analysis of Map.

Mining and quarrying as before suggested have greatly declined in importance but a revival is taking place. The most striking features of the map are a greater density of population engaged in either mining or quarrying in the St. Austell and St. Just divisions.

The general average grade shown over most of the peninsula is 1 to 5% only. The south-east and the scattered fishing areas show even less density. The heavier areas, however, are only just over 10% density. Intermediate between these grades are the Camborne and Redruth central mining area, and the Camelford slate quarrying area. The Central Mining area shows a lower grade owing to the great decline in the industry which is now partly improved.

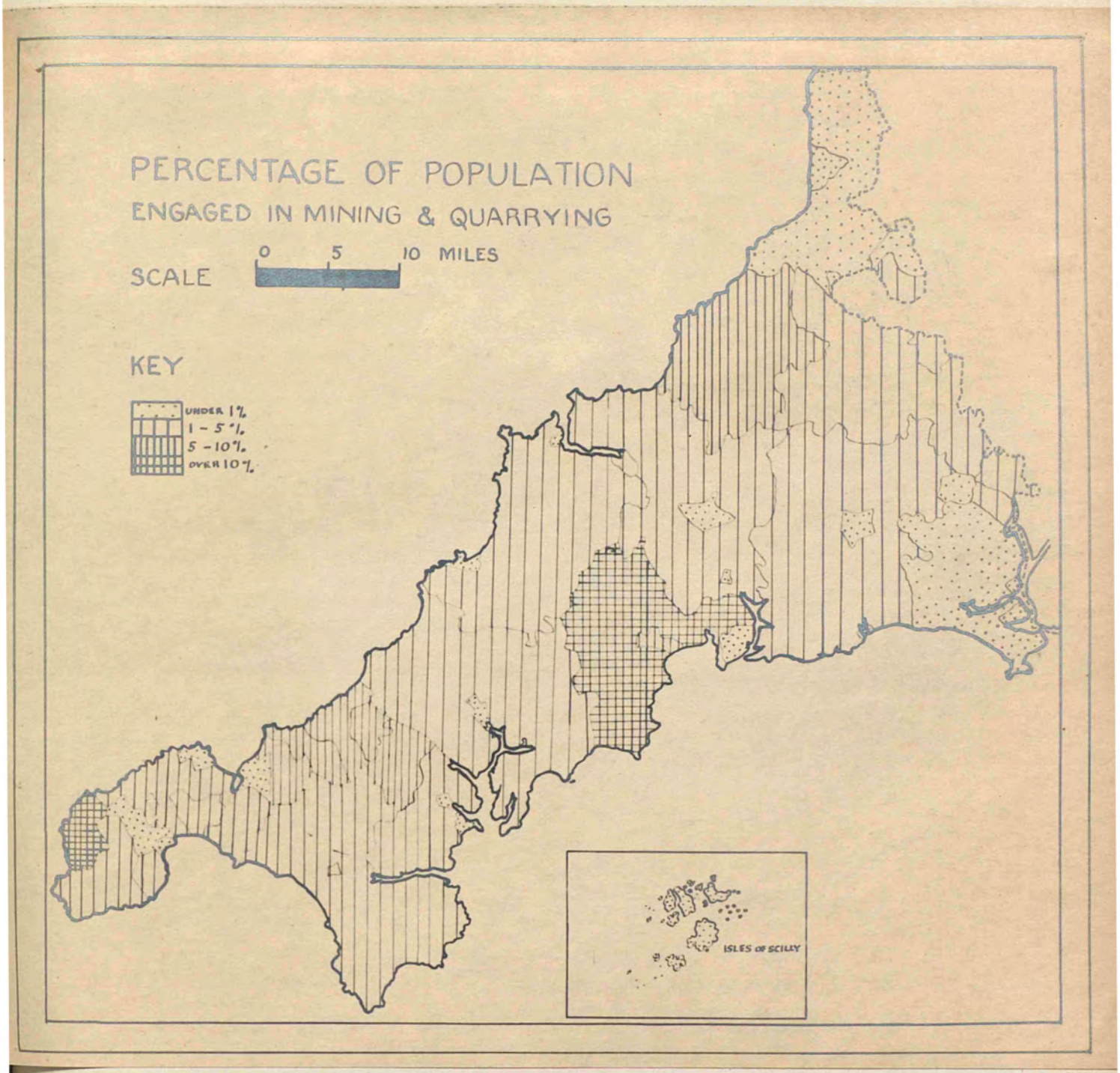


Plate 22. Percentage of Population engaged in Mining and Quarrying.

CHAPTER VII.

Other Industries.

The area under discussion has no lack of subsidiary industries which may be grouped under the following heads:-

(a) Industries allied to mining and quarrying.

(b) Industries allied to fishing.

(c) Shipping and boat building interests.

and

(d) The Tourist industry - only subsidiary in the sense that it forms a part time occupation. It is, however, exceedingly important.

Type (a) includes all Foundry and Iron Works manufacturing rock drills and explosives as at Camborne, Redruth, and Hayle. Also many slate and cement companies are found in the inland towns - St. Austell, Camborne, Truro, and Hayle. There is one tin smelting company at Redruth, the mining centre in many ways.

Industries allied to fishing include the curing and cleaning of fish, packing for the e xport trade as at Mevagissey, and the "cooper" industry.

Among rural industries the typical serpentine industry of the Lizard peninsula must be mentioned.

The tourist industry is becoming of increasing importance from year to year and the north coast especially appears to be growing. New building areas are quickly springing up on almost every headland. Newquay as a centre is developing

rapidly. Reliable figures are not available but each year a greater holiday population is found in the south-west at such centres as Penzance, Falmouth, Newquay, Looe, and Padstow. The 1931 Census was unfortunately taken at an earlier date so that summer visitors are not included. The period most favoured is summer and autumn and in mid-winter there is a smaller proportion of visitors.

PART III.

CHAPTER VIII.

Population and Transport Conditions.

At the present day as throughout history the south-west still preserves in a strong degree a sense of individuality lacking in many districts. For many years a stronghold of the Celtic race, which persisted here as in the mountain fastnesses of Wales and Scotland, the region has always possessed a local population of a peculiarly independent type. Although the pure Celtic race died out during the 17th century yet the descendants are to-day distinguished by their strong sense of kinship, excellent physique, courage and fortitude. They still hold fast to tradition and superstition which survives in folk lore and legend. Isolation has been the chief factor responsible for such development. The region is a unit in itself but more especially is this true of the Cornish peninsula since the Tamar has acted as a racial barrier. The Saxons never penetrated far west of the river. In Norman times and later, contact with other areas was brought about by trade in wool, dried fish, and mine and quarry products. Colonisation and emigration have been strong forces in broadening the outlook of the Cornish. During the 19th century the slate quarriers of Penryn and the tin and copper miners were forced to emigrate to quarries and fields abroad. Although scattered by economic forces they yet feel an even stronger sense of kinship and regard emigration as

exile. The town of Camborne in the centre of the mining district is extraordinarily cosmopolitan in its associations. Though its inhabitants are Cornish at heart yet many have themselves returned from foreign fields or have an interest there still. It is not, therefore, so surprising that small mining districts and local valleys or hills in every continent are known to them almost as well as their native County.

The sea played a great part in the development of Cornish character. Although it produced the wrecker and the smuggler yet the strong and independent Cornish seafarer of these rockbound coasts is a type which it is hard to find elsewhere.

Regarding the distribution of population the Cornish peninsula like the south-west as a whole is characterised by a remarkably sparse but even spread.

The entire area of the south-west peninsula supports a sparse but more or less evenly spread population when compared with other districts such as the south-east of England which is more rapidly changing. Geographic factors in the south-west still exert to a much greater extent their original influence on the region. In Kent according to statistics for 1921 the average density of population per square mile is 768 - in urban districts it is as high as 4160 and the average for rural districts is 286. This is the County average inclusive of all urban and municipal districts in the four south-western Counties of Devon, Somerset and

Dorset and Cornwall. In the south-west as a whole, therefore, the spread is remarkably even, yet sparse. Taking rural districts the following are the densities in each County of the south-west expressed as persons per sq.mile:-

Cornwall.	Devon.	Somerset.	Dorset.
128	64	128	128

Average densities of urban and municipal districts are very varying:-

Cornwall.	Devon.	Somerset.	Dorset.
1536	2432	3328	3840

Regarding increase or decrease in population in these areas the 1921 Census returns only are available in detail. The intercensal period 1911-1921 includes the war years and, therefore, shows a more marked decrease in many cases than the normal trend indicates. In Kent however the increase was 9.2%. The south-western Counties showed a slight increase but Cornwall a decrease as follows:-

Cornwall.	Devon.	Somerset.	Dorset.
- 2.3%	1.4%	1.7%	2.2%

A similar distribution to that found in Cornwall is found also in parts of Scotland, Ireland and Wales and in Brittany where there is a similar type of country. The "crofter" of Scotland leads a similar economic life to that of the mixed farmer of Cornwall who depends for his livelihood on a mixed economy on a very small scale and often has some fishing interests in addition to farming. In

Brittany and the Cornish peninsula there is apparent the pull exerted by the coasts, the small areas of richer agricultural land, and the urban centres. Heavy rain on the uplands causes winter pasture and development of stock industries as in Cornwall. Typical of all the areas mentioned above is a sparse but evenly spread distribution of population living in small village sites or even mere hamlets.

Regarding the population control exerted by either agriculture of industry it is clear than the pull of population towards mining areas is now of much less importance than in the nineteenth century. The coastal pull towards fishing centres is still felt but is declining in strength. Therefore at the present time at least, agriculture has no near rival as the staple industry. Consequently the population tends to be uniformly spread. All production is definitely small scale and local and therefore a large number of small market centres each serving its own district has arisen. For the Lizard peninsula Helston and St. Keverne are typical examples. Camborne serves the mining area in close proximity and Truro a more extensive area.

A comparison of the population density maps for the following dates is interesting and throws much light on the vicissitudes of the mining industry of the west - 1871,1881, 1921, and the preliminary estimate for 1931 showing the probable areas of increase and decrease. In 1871 before the exodus to mining fields abroad there was a strongly marked

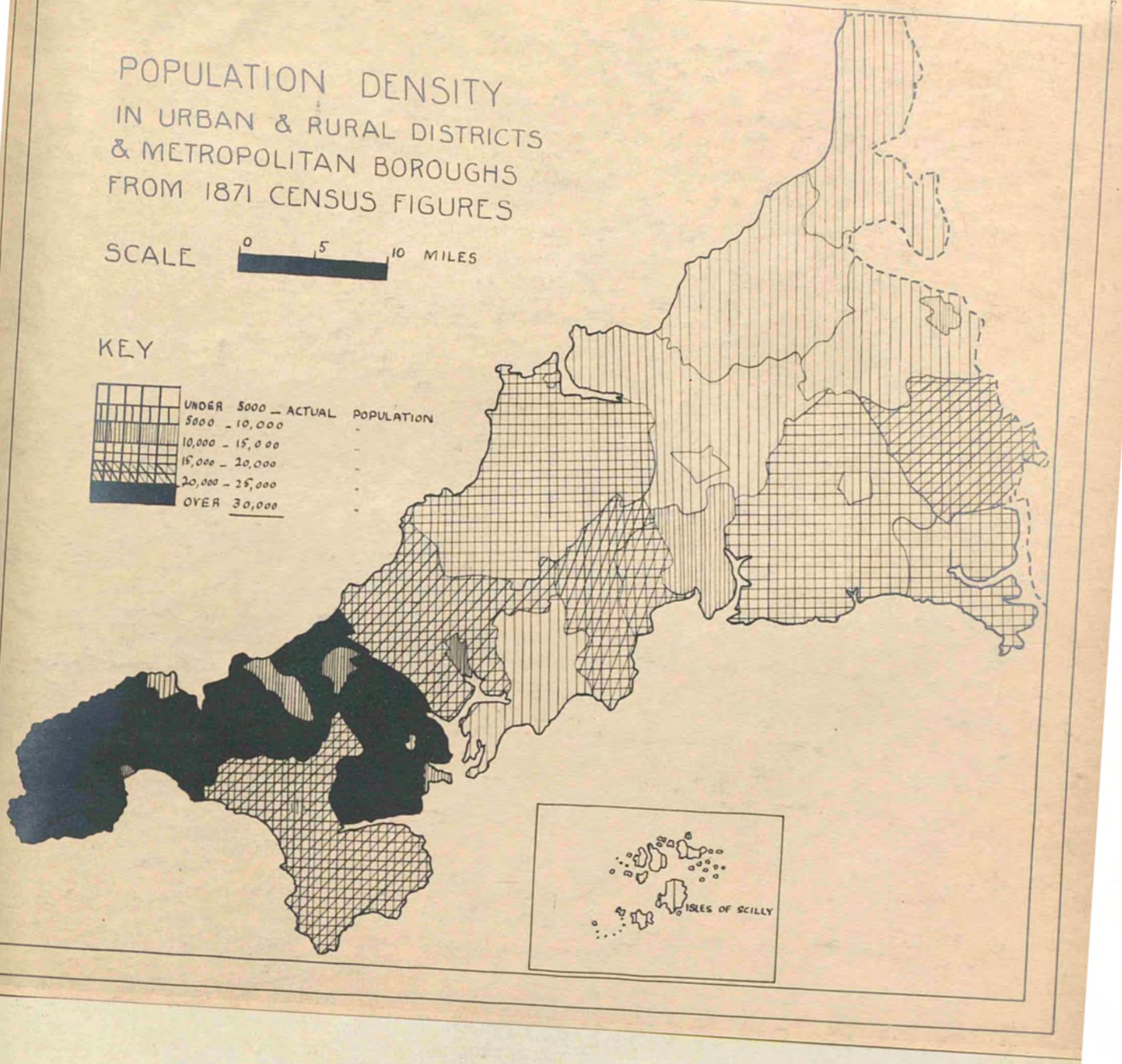


Plate 23. Population Density - 1871.

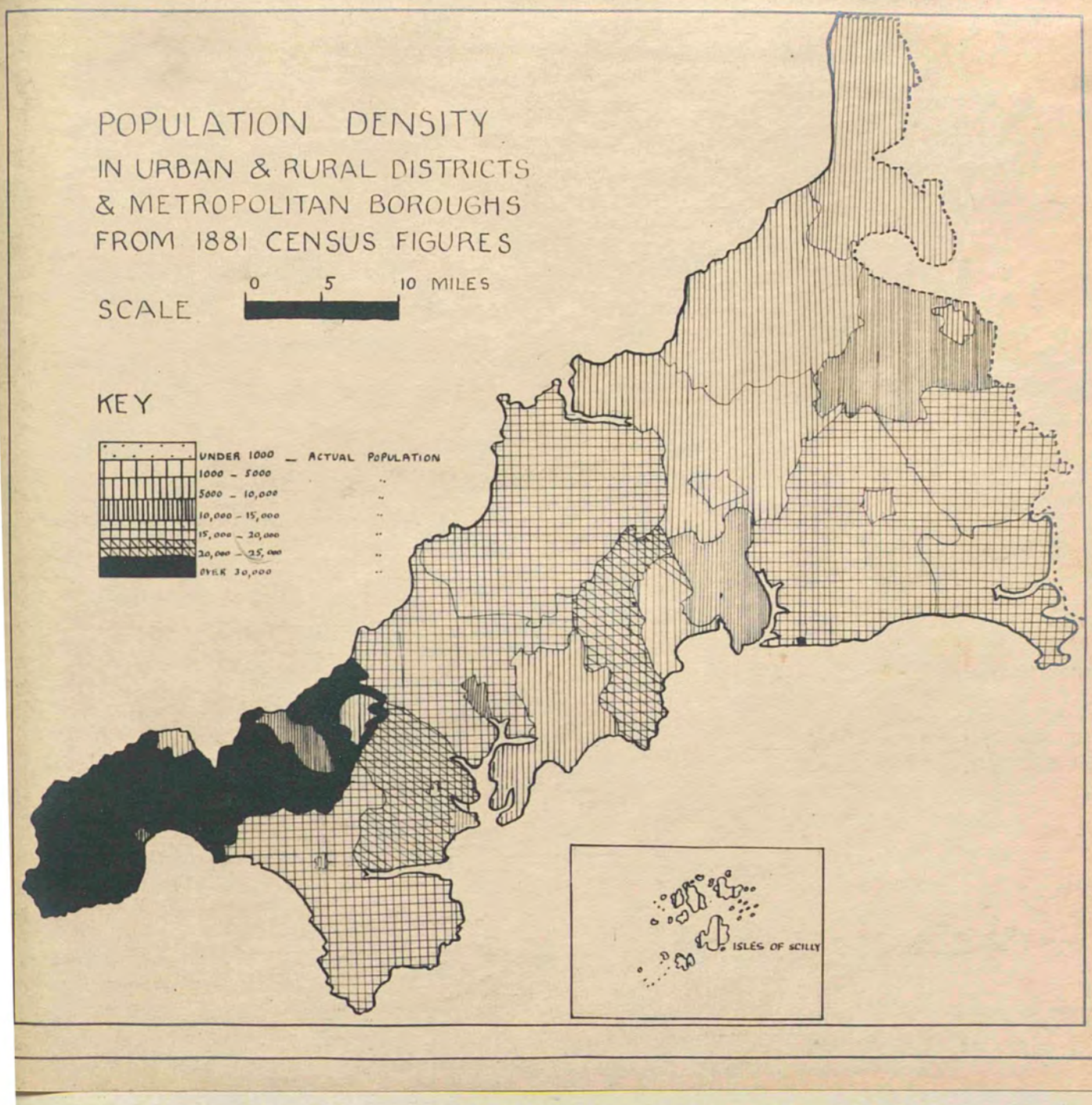


Plate 24. Population Density - 1881.

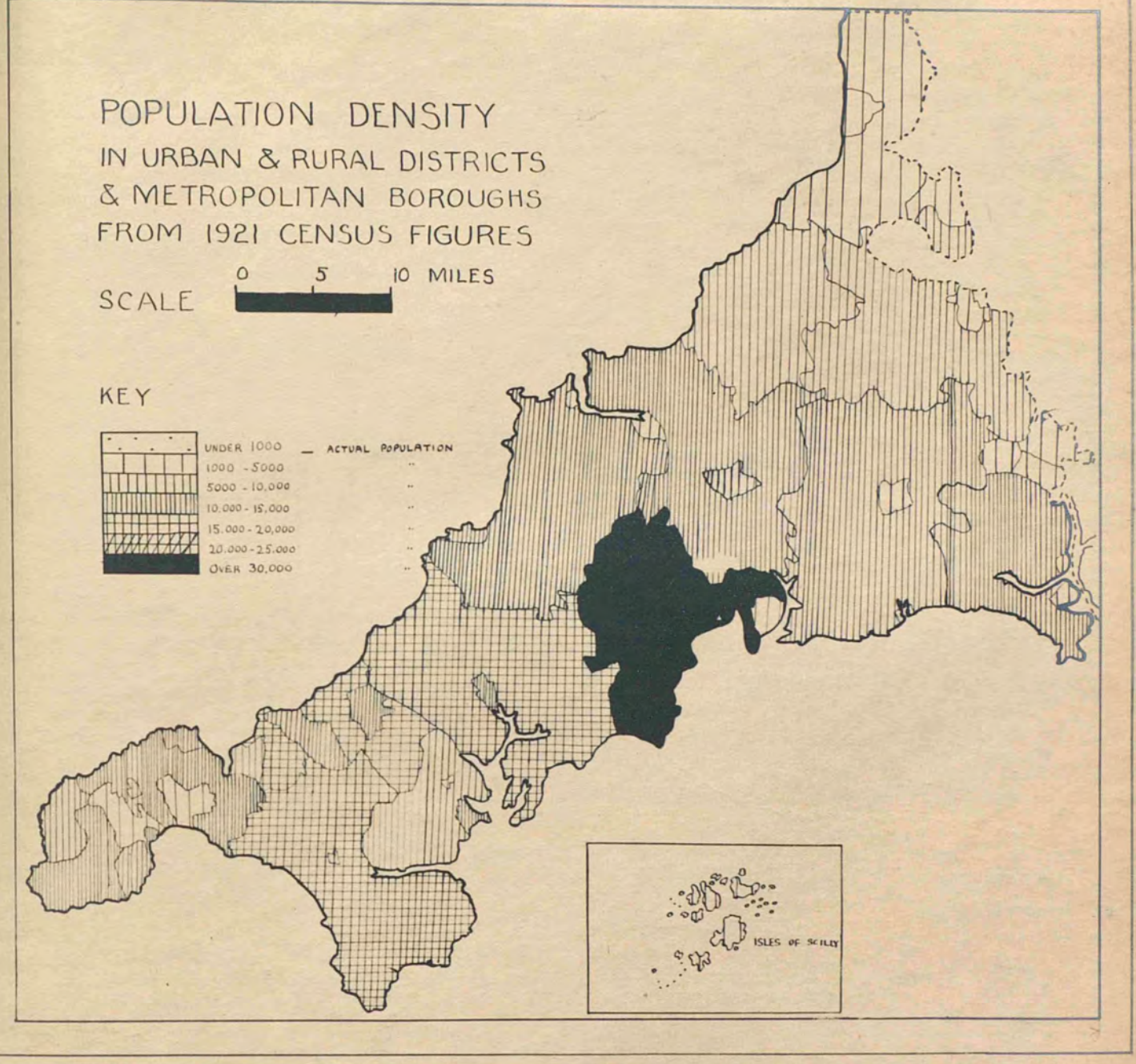


Plate 25. Population Density - 1921.

concentration in East and West Penwith and also in East Kerrier in which division Falmouth was then an important trading port. St. Austell had a less dense population distribution than at the present day. In 1881, still during the exodus but 10 years later, there was a similar concentration to that of 1871 in East and West Penwith only. Even at that date St. Austell had no such density as at present. The 1921 figures show a population of over 25,000 in the St. Austell district. On this map there is no indication of marked concentration in any one mining area as at earlier dates. The general uniformity is only broken by a slightly increased distribution in the south-east area, and in the districts of Penwith, Pydar and Trigg. Of these the south-east is purely agricultural, the south-west has a mining interest[X] but appears to lack capital at present, and the middle north coastal area combines fishing with agriculture. The boroughs and urban districts show no special distribution as do the rural areas but vary exceedingly. It is interesting that no one town has a population of over 25,000 and therefore does not come within the scope of the Town Planning Act although Regional Planning has begun. In addition St. Ives and some other boroughs have begun town planning schemes although not compelled to do so under the Act.

X Mining Magazine 1930.

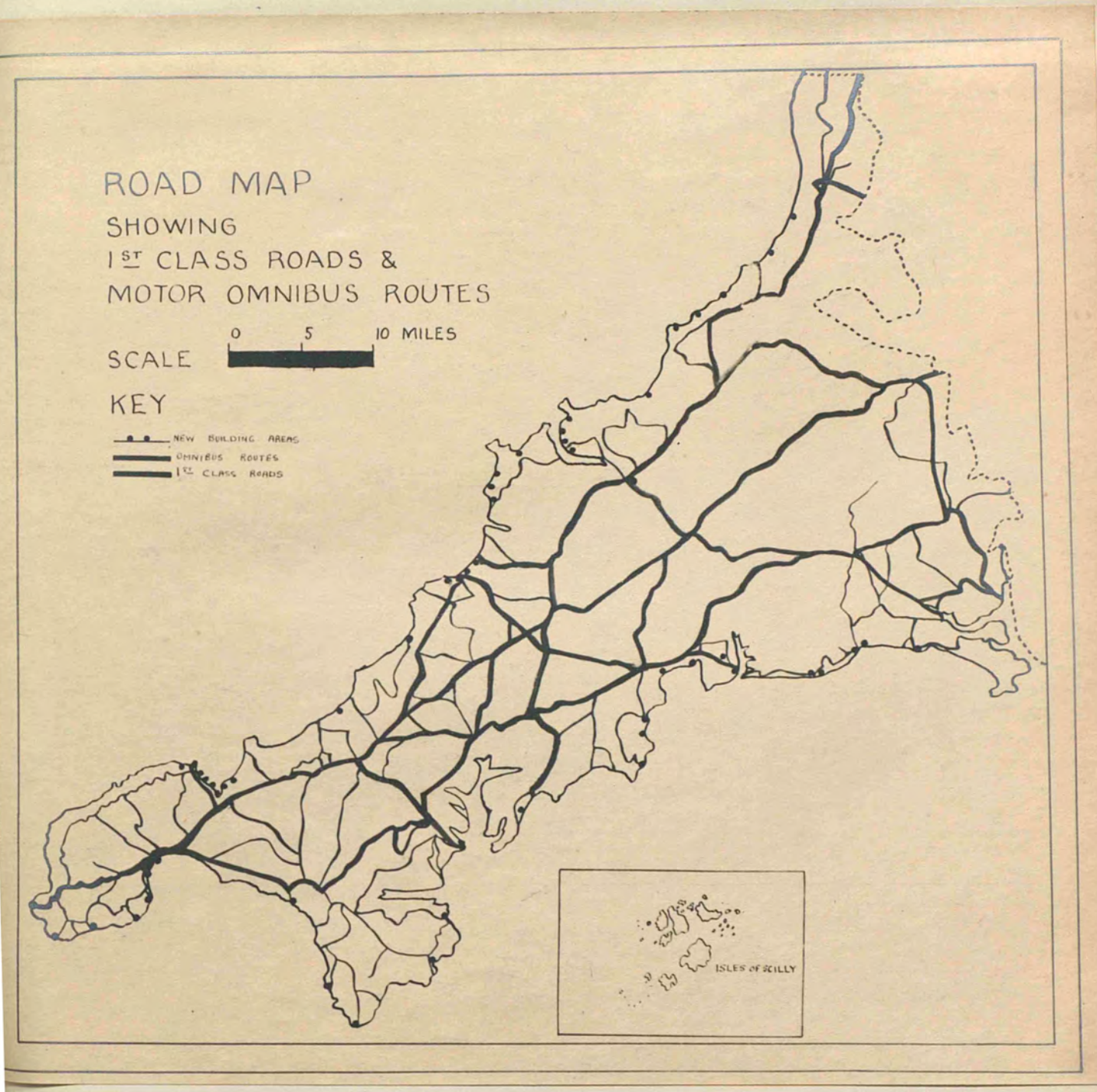


Plate 26. Road Map.

The population may be grouped under the following heads as regards density:-

(a) Small village sites - average density 64 per sq.mile,
e.g. Bodmin moors, Penwith.

(b) Larger inland towns - average density 1280 " " "
e.g. Launceston, Lostwithiel, St. Austell.

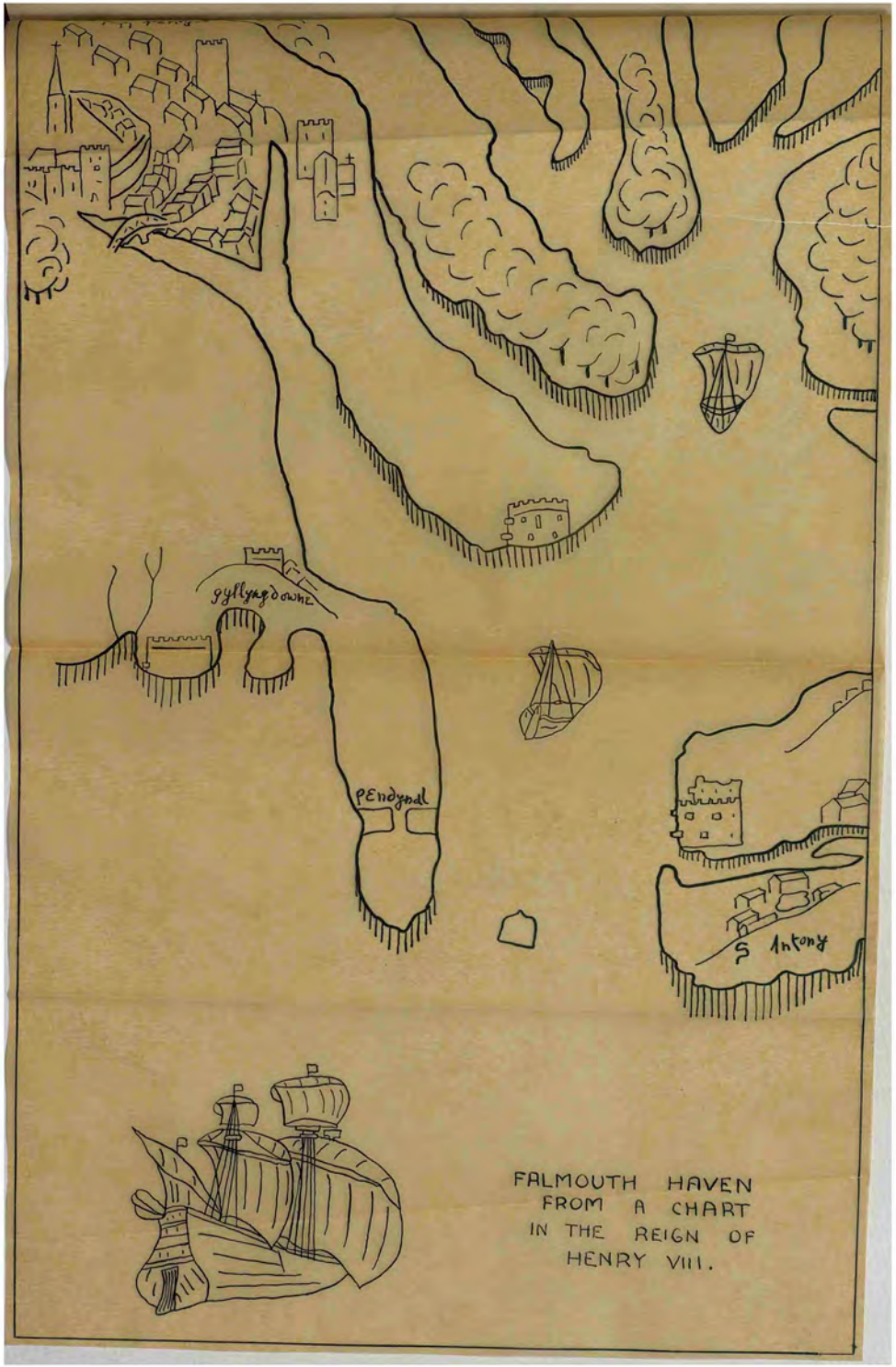
(c) Mining districts - average density 1280 - 1600 " "
e.g. Camborne, Redruth.

(d) Riviera district - average density 1088 - 2112 " "
e.g. Falmouth, Penzance.

(e) Expanding holiday resorts - average density 4928 max.
e.g. Newquay.

Transport services are adequate but were not greatly developed until recently. There is a rail pattern of the peninsular type with some branch lines. This is important only for the coastal resorts and the tourist industry there carried on. As regards the agricultural industry rail lines generally are of little importance except perhaps for the Penzance area with its London market. Good road development in each district is essential and recently adequate omnibus services for weekly marketing have arisen to meet the increased demand. All new residential areas are determined by the new omnibus services as shown. In the case of the fish export from Newlyn speed is an important factor and therefore rail transport is more effective. In all other cases a motor traffic and good road network are all-important.

Illustration 52. Chart of Falmouth Haven.



FALMOUTH HAVEN
FROM A CHART
IN THE REIGN OF
HENRY VIII.

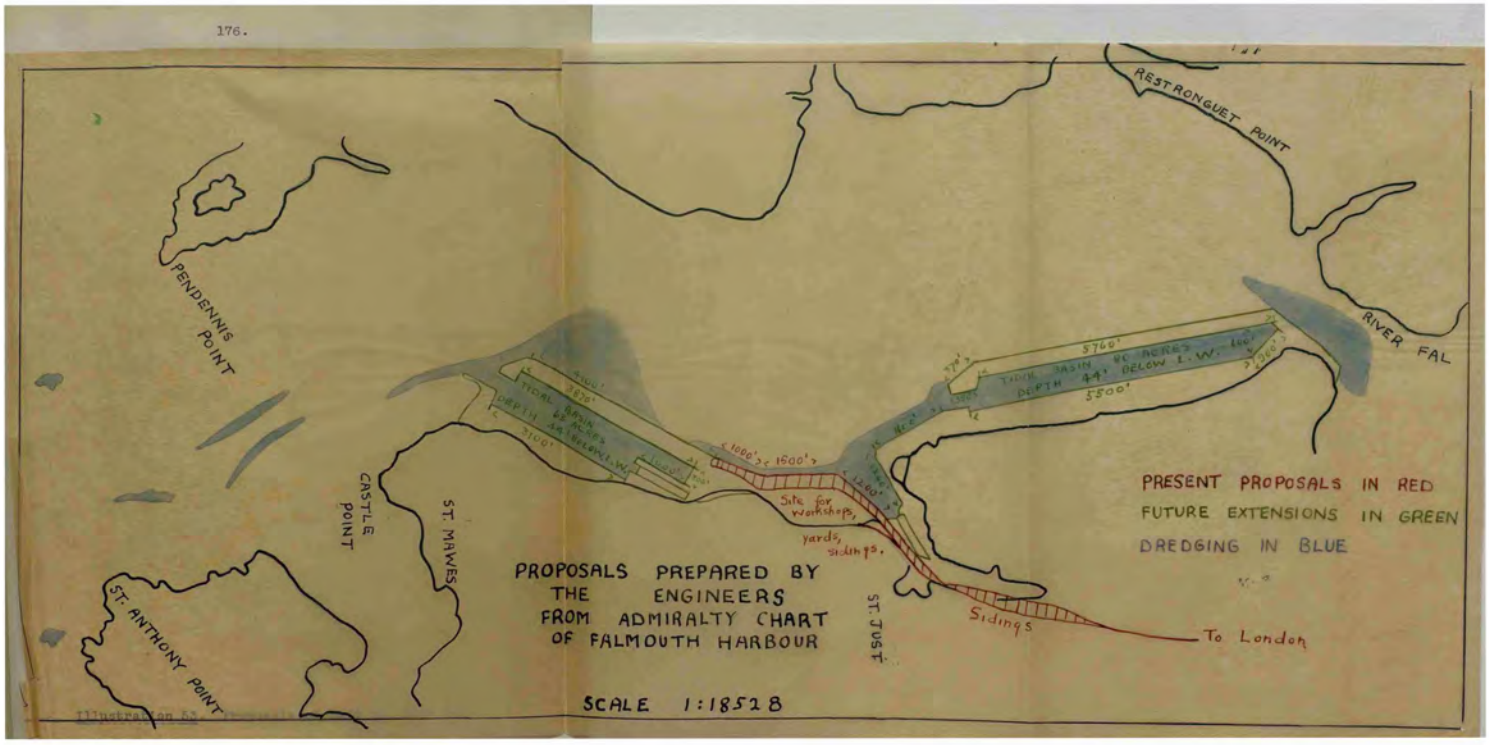
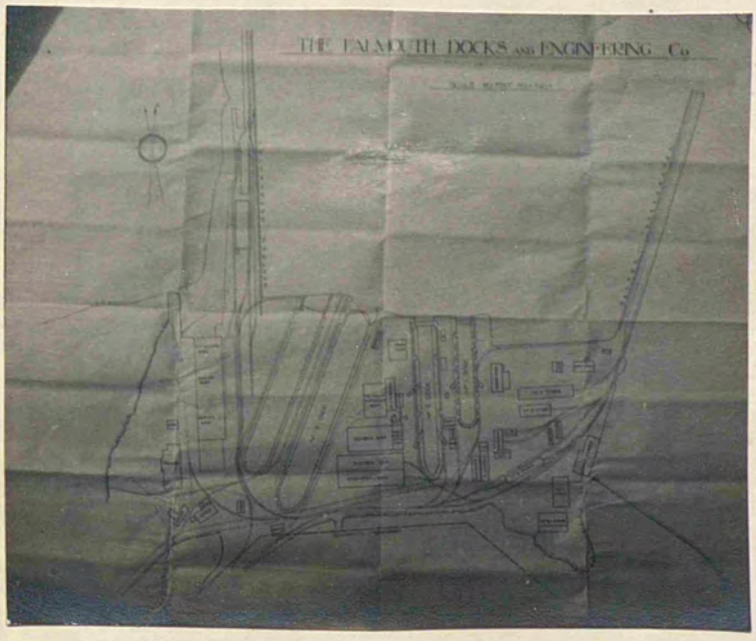


Illustration 52



Photograph 23. Chart of Falmouth Harbour.
" 24. Falmouth Dock Plan.

(enlarged from smaller photo: prints.)

Falmouth - No. 1 Dock.

Eastern Breakwater.

PHOTOGRAPHS 25, 26, 27

3 AND 4 DOCKS.

Regarding the development of ports and harbours there are no ports except Fowey and Falmouth. Each small bay has its sheltered fishing harbour however. Fower is the older of the two and exported wool and fish in early days. Its importance to the china clay industry is discussed in Chapter VI. Falmouth in spite of the harbour was not developed until 1688 when it became a port for Spanish mail packets. The last century saw the greatest development of the service and of the port itself.

Falmouth is to-day a repair port rather than a trading port in the accepted sense of the term. In 1919 however proposals were considered under the St. Just Act for its development as a passenger port since the magnificent harbour is the first reached before Southampton. The development contemplated is shown on the plan. Dock and quay space was provided for and the St. Just district chosen as the port of debarcation. The proposal has not been carried out. The docks are owned by a private company and not by the Railway as in the case of Southampton. Access however to the rail line is easy since it is adjacent. The plan suggested would shorten slightly the water route to Southampton and also help to lessen the congestion at that port.

The preliminary estimate only of the 1931 Census is available. The figures given as shown on the map indicate both increase and decrease of population in different districts. There is however a large proportion of the area

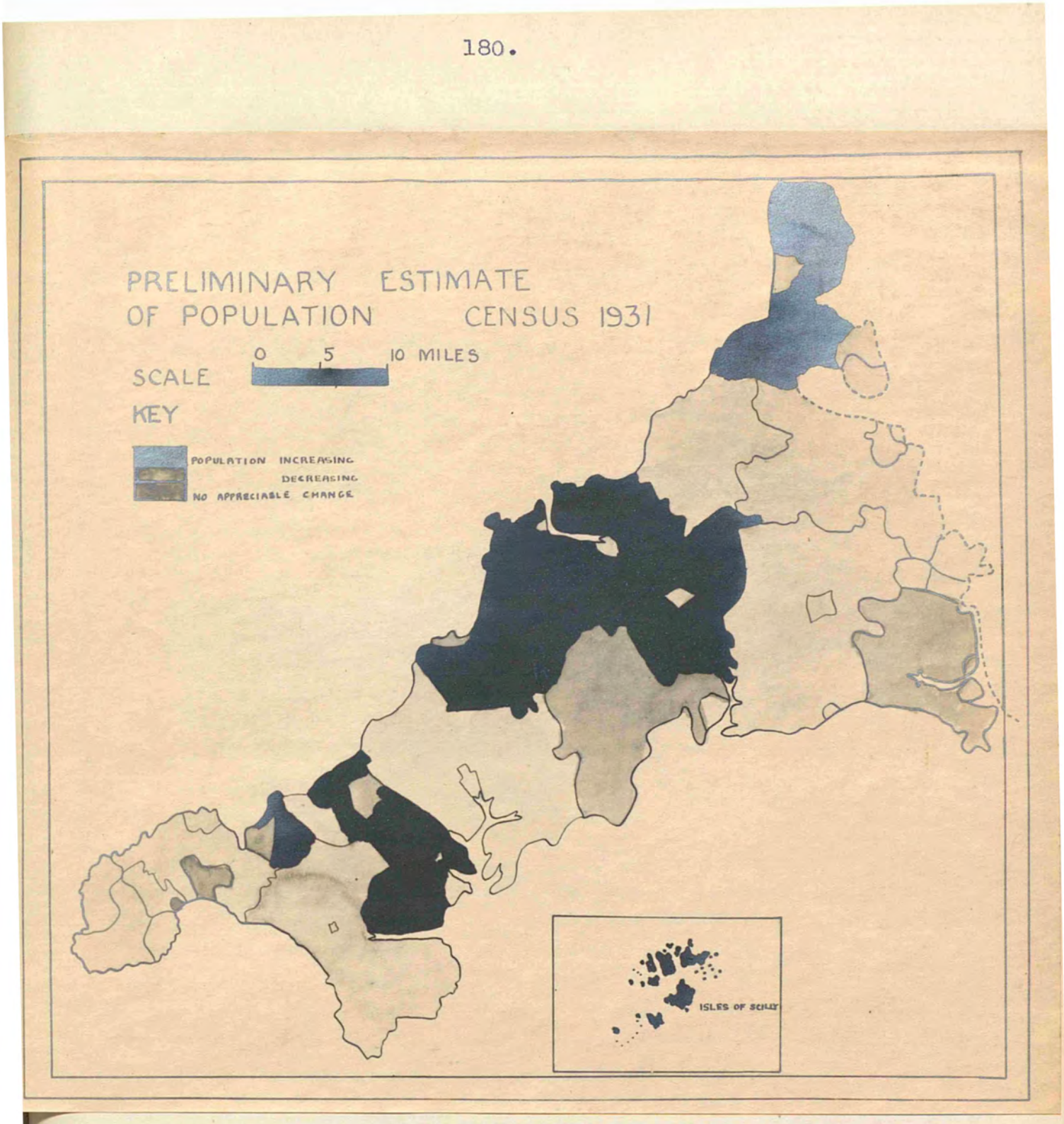


Plate 27. Population 1931 (preliminary).

over which the population conditions do not appear to have changed considerably. It is true that the south-west as contrasted with the south-east is changing very gradually.

It is interesting that parts of the Redruth area , the Newquay and Padstow districts, Bodmin, Stratton and the Scilly Isles record an increase according to the estimate. There is a slight decrease in the St. Austell area, the south-east, and part of the Mounts' Bay area.

As is shown on the Road Map new residential areas are developing in close proximity to motor omnibus routes.

CHAPTER IX.

Future of the Region.

The future of the south-west is bound up with the question of developments which may be possible in the direction of tin mining. The discovery of clay deposits in southern states of U.S.A. is beginning to affect the kaolin industry. Regarding agriculture and the fishing industry little change is likely as yet especially in the fishing industry. Mine and quarry products are the only ones which are affected by world conditions and where competition is keenly felt. It is the foreign competition coupled with wasteful methods, which has, since 1880, brought about the decline of the tin mining industry of the west. It should be stressed in this connection that the introduction of compressed air drills and high explosives was checked by the growing competition abroad and therefore the test has not been a true one. Provided a higher price of tin in the market and a growing world demand it should be possible to restart the Cornish mines when capital can be found. In 1930 a voluntary restriction of output was agreed upon on an International scale in accordance with recommendations of the Tin Producers' Association. Improved methods of mining, milling and dressing of the ore will be essential as will also much energy and enterprise. It is thought the mines of the west are not exhausted but merely neglected. W.R.Jones says in "Tinfields

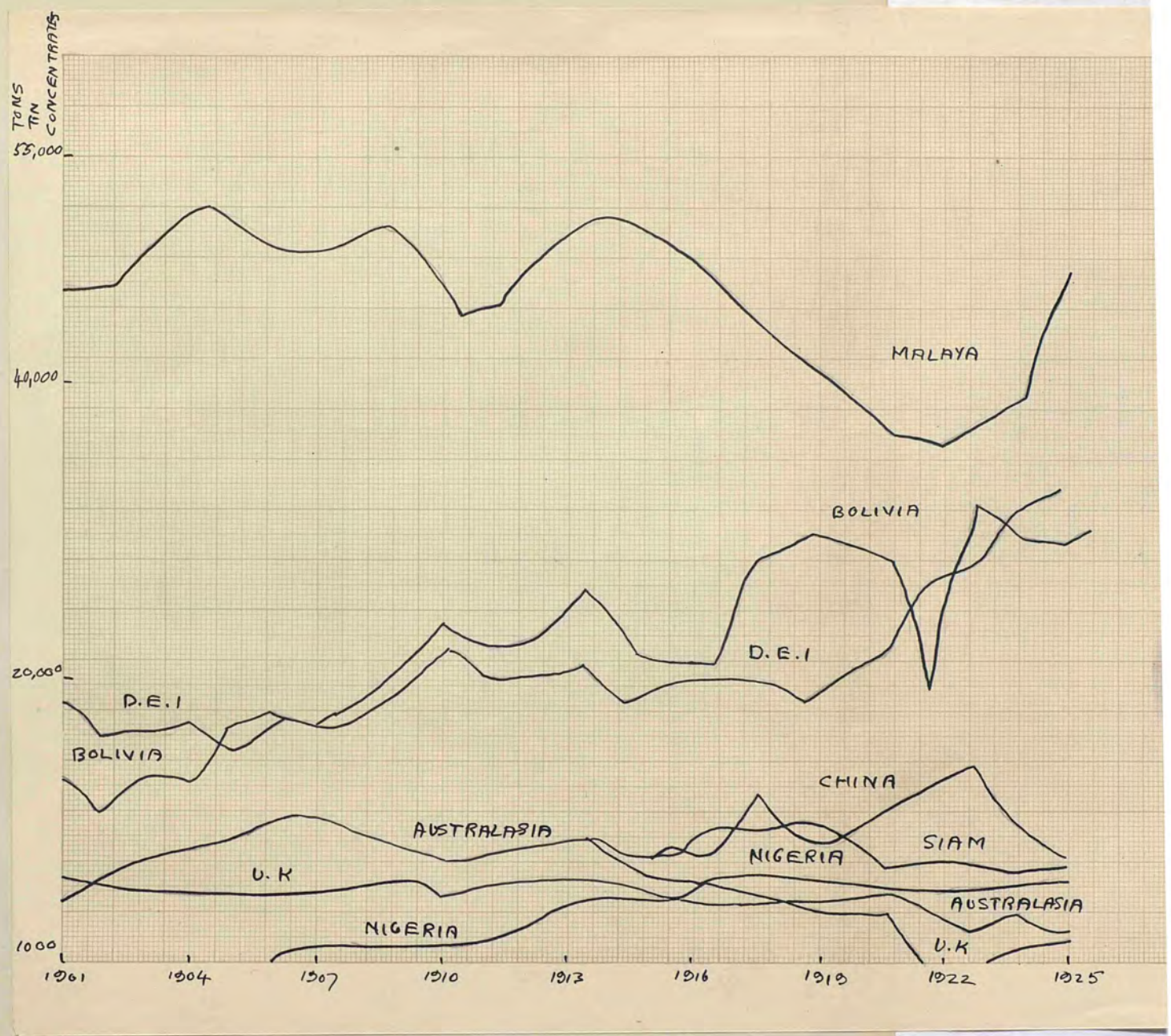


Illustration 54. Graph of Tin Production by Countries.

of the World" 1925 that "in 12 years the Camborne area will be more important than say the Taiping valley".

With regard to foreign competition 4 main areas or "metallogenetic" provinces are predominant. These are the Straits Province, Bolivia, China, and Nigeria. In 1924 the production was as follows:-

Straits	63%	of world output.
Bolivia.....	21%	" " "
China.....	5%	" " "
Nigeria.....	4%	" " "
Cornwall & Devon..	1.3%	only.

Before 1800 the richest ores only were worked and the poorer ones were neglected. Many of these should now prove of value.

The Straits Province produces the greatest amount of tin - about 40,000 tons annually - nearly all of which is alluvial.

Development is thought possible by the Cornish Chamber of Mines and the Cornish Institute of Engineers in the area north of East Pool, South Crofty, and the Roskears.

A comparison between the two forms of tin mining - lode and alluvial - is interesting. Lode mining was introduced about 400 years ago and has been the chief method employed until 60 years ago. Then the alluvial tin of the Straits was discovered which dealt the last blow to the lode mining of the west of England. Lode mining is more costly in that problems of ventilation, drainage, timber support and artificial lighting

are met with. Blasting of the rock is also necessary and prospecting is risky since the lode may thin out. Thus great expense is involved. The only other lode areas are Bolivia, Tasmania - where the alluvial is already worked out - parts of New South Wales and Queensland, and in Europe Czecko Slovakia. To-day about 4/5 of the world production is alluvial but cannot last indefinitely. Bolivia is the only new producer. The working advantages include low costs, and the possible use of hydraulic dredges. Prospecting is not risky since the extent can be seen in the first place. Tin in Bolivia is becoming of increasing importance and is lode tin as in Cornwall. The ores are complex but yield up to 5% cassiterite. The disadvantage of altitude alone makes working difficult and expensive.

China exports about 6000 tons but has in addition a large internal consumption. Alluvial tin only is found. Nigeria produces about 7000 tons each year but this will increase as transport and improved methods are developed.

Previous to the discovery of foreign tin fields Cornwall accounted for $\frac{1}{4}$ of the world total which by 1894 had fallen to 1/10 only.

The Report of the Tin and Tungsten Research Board in 1922 makes certain suggestions regarding the tin mines of Cornwall. Work was begun in 1916 and the existing methods of extraction and economic production enquired into. The Institute of

Mining and Metallurgy and the Cornish and Camborne local Research Committees were concerned. Two questions were dealt with (a) methods of dressing the ore without waste and (b) how best to remove the ore. The first question was investigated by Professor Truscott who was in favour of modern slime methods of dressing the ore. He also thought it possible to save the finely divided tin and thought a process of regrinding necessary.

New chemical methods of removing the ore and of separating allied products were investigated. There were 3 methods suggested but all proved expensive and unpractical in use. Investigation, however, is of value for the period when mining revives and when the newer methods may be possible when capital is available. Once installed they would probably result in more economic production.

Hatfield's process to separate minerals with different dielectric constants met with some success. At present the wolfram is separated by electro-magnets. It is stated there are other processes which were not examined at that date but which are worth investigation.

The Regional Planning Scheme as has been shown by Harding Thompson in the Report issued in 1930 provides for the reservation of definite areas for (a) mining interests, (b) coastal parklands, (c) amenities for purposes of recreation, and for the protection of the coasts. It is, however,

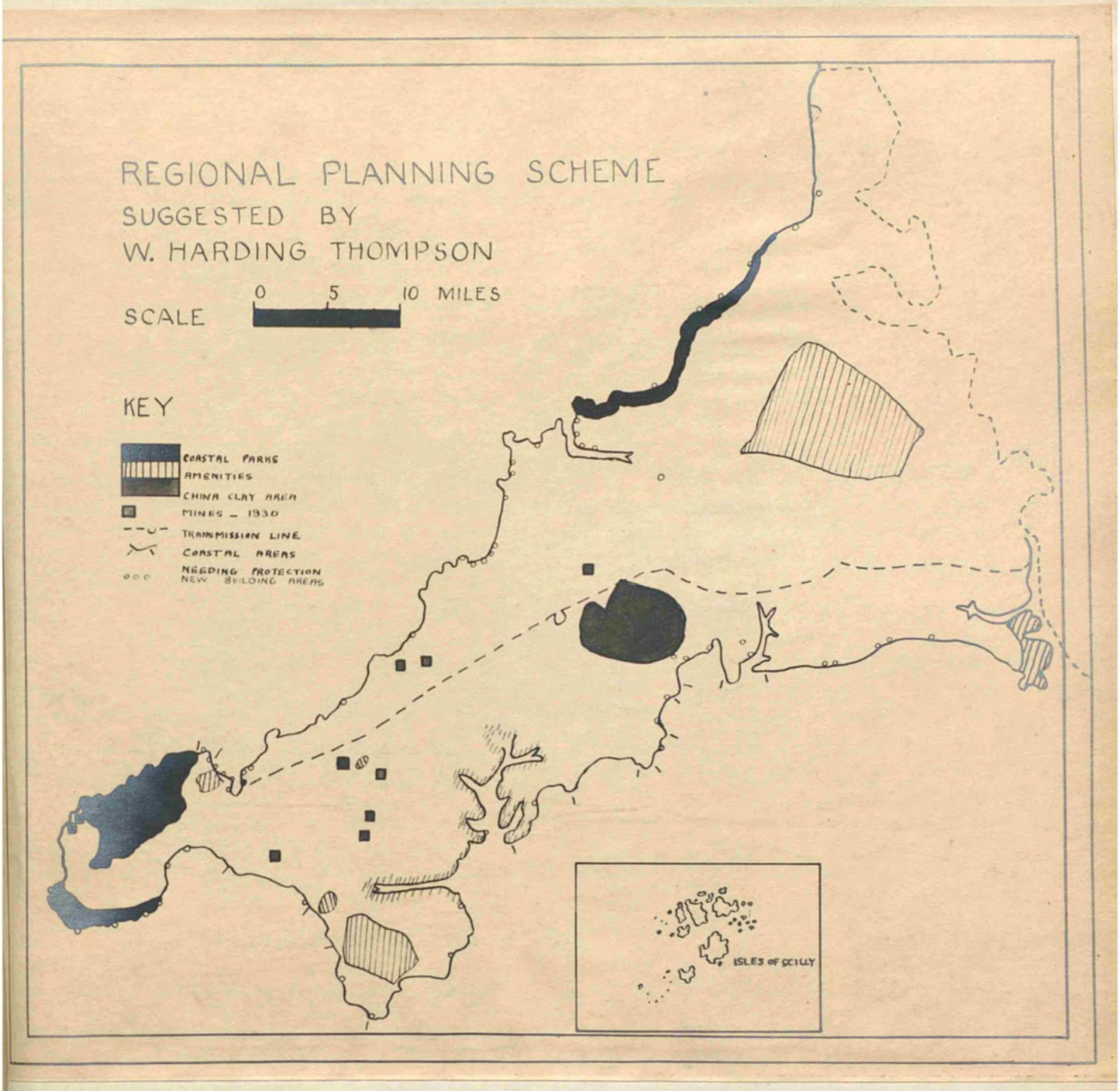


Plate 28. Regional Planning Scheme.

impossible to carry out these suggestions without the co-operation of local authorities which, under the Act, are not compelled to issue draft schemes. St. Ives, Newquay, and other Corporations, however, have undertaken town planning schemes. These should prove of value in maintaining the practical application of the ideals suggested in the Report. The problems with which the Committees appointed will have to deal include (a) communications, (b) zoning, and (c) reservations and amenities. Therefore detailed individual schemes are essential. Types of open space would include both public and private districts. There would also be "agricultural reservations" and areas where the people have limited rights as on the moorlands where grazing is permitted. Mine and quarry rights belong to the owner and the people here have no rights of any kind.

Co-operation with these ideals in view should ensure for the south-west a permanent area of landscape value immune from unsatisfactory building arrangements or defective zoning.

Improved conditions in the Fishing Industry are not likely at present. Methods of sighting shoals from the air have been tried but with little success except on still days when the sea was calm and clear. Development in this direction is not likely. Also the migrations themselves are not fully understood.

The aim of those who plan the future regional development should be rather to regulate building and transport development than to alter the clay or tin mining districts which have an appeal of their own. The Cornish motto "One and all" should be thus interpreted that each district may retain its old appeal which to Cornishmen overseas is so strong that all seek to earn enough in order to return.

Thus any changes in the future in this region may occur in the neighbourhood of the tin mines (industrial) or within a short distance of the coasts (residential). Agriculture is likely to remain the staple industry. Developments may be expected in the direction of soil improvement, co-operative marketing and dairying associations, and improved methods of farming generally including the more efficient keeping of records and the assistance of Inspectors in both mixed farming and dairy districts. The two experimental stations, one in the south-west intensive market garden area and the other in the south-east, carry out liming experiments. The soils are deficient in lime and phosphates. When potash is also lacking the deficiency is accentuated by the dry spring and summer and cold period late in June. Therefore the addition of lime is essential.

APPENDIX I.

EAST POOL AND AGAR LIMITED.

Year.	Tons of Tin. T.	C.	Q.	L.	Value. £		
1913	528	11	1	9	62,176.	2.	2.
1914	644	6	3	18	54,835.	13.	10
1915	597	1	0	17	53,042.	8.	2.
1916	914	2	2	4	94,495.	11.	3.
1917	943	11	0	15	129,263.	7.	4.
1918	1280	3	2	9	249,543.	13.	7.
1919	1004	13	1	4	138,149.	15.	6.
1920	874	12	3	1	152,014.	17.	2.
1921		-			14,989.	1.	1.
1922		Nil.				Nil.	
1923		Nil.				Nil.	
1924	541	14	2	6	79,330.	14.	9.
1925	897	11	2	5	144,143.	13.	0.
1926	1085	2	2	0	181,716.	7.	7.
1927	974	11	2	22	147,872.	14.	1.
1928	939	16	1	9	118,644.	11.	4.
1929	1029	1	0	27	125,677.	3.	6.
1930	900	9	3	4	81,125.	5.	1.
1931	555	3	0	26	40,280	17.	8.

EAST POOL & AGAR LIMITED.

Other Products.

		T.	C.	Q.	L.	Value.		
1913	Arsenic (21c)	238	11	0	0	£ 1,964.	15.	1.
	Wolfram	45	10	3	26	5,036.	5.	11.
	Copper	20	0	0	0	100.	0.	0.
1914	Arsenic (21c)	455	12	3	0	3,970.	17.	11.
	Wolfram	107	12	0	10	11,113.	3.	11.
1915	Arsenic (21c)	804	14	2	0	11,219.	2.	10.
	Wolfram	127	2	3	23	20,000.	0.	4.
	Copper (21c)	14	20	3	0	112.	0.	10.
1916	Arsenic (21c)	526	11	0	0	12,434.	5.	7.
	Wolfram	100	10	3	25	17,542.	16.	6.
	Copper (21c)	10	13	1	0	173.	11.	5.
1917	Arsenic (21c)	488	17	0	0	34,062.	0.	2.
	Wolfram	71	0	3	23	12,875.	9.	10.
	Copper (21c)	5	0	0	0	60.	0.	0.
1918	Arsenic	419	14	0	25	30,495.	8.	6.
	Wolfram	57	6	3	4	10,237.	4.	0.
	Copper			-		-		
1919	Arsenic	588	13	3	17	21,892.	5.	1.
	Wolfram	71	18	0	24	5,502.	0.	8.
	Copper	10	0	0	0	120.	0.	0.
1920	Arsenic	500	17	3	12	22,728.	3.	3.
	Wolfram	46	16	0	2	1,024.	5.	0.
	Copper			-		-		
1921	Arsenic	494	6	2	14	5,221.	13.	4.
	Wolfram	8	15	0	21	96.	4.	8.
1922	-			-		-		
1923	-			-		-		
1924	Arsenic	553	6	2	21	12,242.	2.	2.
1925	Arsenic	1289	17	0	2	10,145.	10.	5.
1926	Arsenic	1179	10	1	23	9,266.	17.	0.
1927	Arsenic	845	15	2	26	8,147.	6.	6.

EAST POOL & AGAR LIMITED.

Other Products.

		T.	C.	Q.	L.	Value.
1928	Arsenic	609	6	2	11	£ 5,918. 8. 8.
1929	Arsenic	427	5	2	0	3,854. 5. 4.
1930	Arsenic	339	13	1	23	3,217. 4. 9.
1931	Arsenic	65	2	1	17	878. 18. 11.

APPENDIX II.

FRED COLLINS, D.S.C.,
Harbour Master and Supdt.
of Works.

Harbour Office,
Albert Quay,
Fowey, Cornwall.

14th July, 1931.

Miss S. Muckle, B.A., Lond.,
at "Hadden",
Shepherd's Lane,
Dartford, Kent.

Dear Madam,

I regret not having replied to your letter before. Pray accept my apologies for same.

Regarding plan of harbour with modern improvements, there is none except those at this Office which of course cannot be let outside. They take quite a long time to make and cannot be endangered outside the Office.

Regarding imports and exports (list appended).

Methods of shipping this china clay is by gravitation ex truck and a combination of gravitation and electrical hoist.

At the moment there is of course a severe trade slump on and not much work is being done either in exports or imports, our figures having decreased 40%.

I should be pleased to let you see plans at this office any time you desire to do so.

Yours faithfully,

p.p. FRED COLLINS

Floating population 14,000

Ships then averaged about 100 per month.

Average number of employees at the Jetties - normally 300.

Largest cargo shipped from Fowey was in the s.s. "Moko Maru" (Jap) 9,290 tons 4 cwts. of china clay.

Total tonnage handled.

1930.	683,447	
1929.	815,880	RECORD FOR THE PORT.
1928.	783,062	
1927.	786,048	
1926.	759,467	
5 /	3,827,904	

765,580 tons 16 cwts - average per year.

APPENDIX III.

Acreage under Crops and Grass and Number of Live Stock as returned on the 4th June, 1929, in the undermentioned Petty Sessional Divisions in the County of Cornwall.

Petty Sessional Division.	Wheat.	Barley.	Oats.	Mixed Corn.	Rye.	Beans.	Peas.	Potatoes.	Turnips & Swedes.	Mangolds.	Sugar Beet.	Cabbage for Fodder Kohl rabi & Rape.	Vetches or tares.	Lucerne.	Hops.	Small Fruit. X	Orchards. X	Other Crops.	Bare Fallow.	Clover, Sainfoin & and Grasses under Rotation.	For Hay.	Not for Hay.	Permanent Grass. For Hay.	Not for Hay.	Total acreage under Crops and Grass.	Rough Grazing.	Dairy Cattle.	Other Cattle.	Total Cattle.	Total Sheep.	Total Pigs.
	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	Ac:	No.	No.	No.	No.	No.
East Kerrier.	302	144	2.033	1.854	-	-	5	255	381	215	7	95	-	-	-	16	76	158	24	2.452	3.656	2.439	12.689	26.799	1.885	6.850	6.114	12.964	3.752	12.571
East Middle.	211	243	2310	1.000	-	17	27	383	310	255	-	419	5	-	-	434	766	273	39	3.445	3.995	4.854	19.169	33.063	5.346	5.670	6.869	12.529	17.451	5.440.
North East.	480	293	3.698	1.208	8	-	-	173	223	278	6	760	-	-	-	13	280	21	45	3.280	4.542	4.4	21.844	41.537	12.342	5.297	9.215	14.512	29.808	3.975
East Penwith.	812	374	2.066	2317	11	7	8	264	587	394	133	154	-	-	-	13	82	789	133	3.737	9.286	1.845	7.631	30.421	3.283	7.084	7.089	14.173	6.674	11.331
East Powder.	522	207	2.137	2.376	12	-	-	178	434	383	-	297	-	-	-	8	125	49	64	2.747	5.192	2.548	12.656	29.943	5.164	4.159	7.466	11.625	14.738	5.413
South East.	196	380	1.787	864	-	19	18	447	447	299	-	326	6	-	-	224	666	274	17	2.344	2.746	3.078	12.564	26.581	1.230	3.322	3.826	7.148	9.200	3.012
Lesnewth.	218	287	3.976	1925	-	-	-	146	208	242	-	1.217	-	-	-	5	78	17	61	3.528	7.773	2.974	19.772	42.429	10.708	3.931	7.905	11.836	37.644	2.567
Pydar.	2.696	4.562	4.584	6.270	-	-	-	317	1.184	1290	80	1.419	5	15	-	20	268	97	443	6.176	15.967	1.926	15.046	68.403	11.831	5.493	12.716	18.209	34.228	7.876
South Powder.	1.188	902	2.549	1.999	-	-	-	113	502	470	6	316	6	-	-	6	100	33	17	2.694	5.760	1.046	8.598	26.306	1.510	2.243	5.707	7.950	13.577	5.321
Stratton.	369	508	5.389	1.381	-	-	-	250	419	442	27	907	22	-	-	8	225	23	48	3.456	6.498	3.997	15.657	39.601	10.049	3.913	8.031	11.944	25.709	3.030
Trigg.	1.284	1436	3.798	3.677	11	-	-	239	541	709	113	1.170	12	-	-	8	198	28	144	4.744	10.216	2.833	15.742	46.927	16.838	4.739	9.147	13.886	29.334	5.203
Tywardreath.	147	139	1.281	986	-	-	-	115	185	144	-	237	-	-	-	-	106	33	20	1.863	3.336	930	6.462	15.985	1.760	1.914	3.331	5.245	8.341	2.507
West Hundred.	1.227	741	4.627	4.225	6	-	13	623	1.173	651	-	852	-	-	-	63	589	51	85	7.655	12.295	4.761	27.492	67.122	10.010	7.886	12.803	20.689	35.873	7.495
West Kerrier.	1.121	665	3.134	4.809	-	-	-	228	776	454	5	67	-	-	-	24	175	212	179	4.191	6.565	3.335	16.022	41.752	7.592	9.226	11.856	21.082	5.702	17.233
West Penwith.	301	314	2.582	3.245	12	5	16	562	621	486	54	128	6	-	-	61	203	1.327	104	4.756	14.364	362	2.039	31.507	8.826	10.546	7.841	18.387	2.571	11.950
West Powder.	1.442	961	3.269	3.215	-	5	19	266	749	544	38	479	5	-	-	35	237	162	87	4.623	8.132	3.464	14.894	42.613	2.918	5.906	8.341	14.247	13.397	11.901

A dash (-) indicates that the acreage is less than 5.

X Includes acreage of Small fruit grown in Orchards.

Ministry of Agriculture and Fisheries,
(Statistical Branch),
7, Whitehall Place,
London, S.W.1.

18th February, 1932.

APPENDIX IV.

Cornwall Education Committee.
Horticulture.
County Hall.
Truro.

H.W.A./FC.

23. 3. 32.

Dear Madam,

With reference to your letter concerning the tonnage of early produce, last year, (1931) the approximate figures for Cornwall and Scilly were as follows:-

Flowers,	2,000	tons.
Broccoli,	20,000	"
Potatoes, (Early)	3,000	"
Fruits, (Soft)	200	"

In all probability the gross value of the intensive produce grown in Cornwall and Scilly would be between £300,000 and £400,000.

Yours faithfully,

Hy. W. Abbiss.

Horticultural Superintendent.

Miss S.Muckle, B.A.,
Bedford College,
Regent's Park,
London, N.W.1.

APPENDIX V.

Imports of Potatoes registered as entering certain ports in the United Kingdom from the Channel Islands during each week of the year 1931. (Extracted from "Weekly Fruit Intelligence Notes" issued by the Empire Marketing Board.)

Week ending:-	Potatoes. cwt.	Week-ending:-	Potatoes. cwt.
3rd January 1931	76	1st August 1931	-
10th	77	8th	-
17th	73	15th	-
24th	55	22nd	-
31st	86	29th	-
7th February	47		
14th	155	5th September	-
21st	111	12th	-
28th	168	19th	-
7th March	121	26th	-
14th	115		
21st	270	3rd October	-
28th	265	10th	-
2nd April	161	17th	-
11th	222	24th	-
18th	374	31st	-
25th	219		
2nd May	192	7th November	-
9th	226	14th	-
16th	498	21st	-
23rd	6,022	28th	-
30th	63,636		
6th June.	129,716	5th December	-
13th	244,889	12th	-
20th	253,880	19th	-
27th	164,317	23rd	-
4th July.	47,765.		
11th	902	2nd January 1932	-
18th.	1,840		
25th	1		
	916,489		

Ministry of Agriculture & Fisheries.
Statistical Branch,
Whitehall, S.W.1.

March 1932.

S.S.10121.

Bibliography.

Geological Magazine.

Geological Survey Memoirs - Cornwall & Scilly Isles.

Quaternary Ice Age - Wright.

Quarterly Journal Geological Soc iety.

Transactions of Royal Geological Society of Cornwall.

Journal of Royal Institution of Cornwall.

Royal Cornwall Polytechnic Society.

Book of Normals - Meteorological Office - 1915.

Monthly Weather Reports- " "

British Rainfall - " "

Cornish Rainfall Association.

Weather of British Coasts - Meteorological Office, 1918.

Agricultural Geology - 1916 - Rastall.

" " - McConnell.

Rocks and Soils - Stockbridge.

Soils and Substrata - Woodward.

Victoria County History of Cornwall.

Lysons Magna Britannia.

Carew - Survey of Cornwall - 1602.

Agricultural Statistics - Ministry of Agriculture.

Census of Cornwall - 1871,1881,1921, 1931(preliminary).

Sea Fishing Industry of England and Wales - Aflalo - 1904.

Annual Reports and Statistics - Sea Fisheries Committee - 1910-30.

Science and Fishing - 1930.

Geographical Journal - 1915 - British Fishing Industry - Gardiner.

British Fisheries - Johnstone - 1905.

Migrations of Fish - Meek - 1916.

Marine Products of Commerce - Tressler - 1923.

Marine Fishes - Cunningham - 1896.

British Fishes - Day - 1884 - Vols. I and II.

Ministry of Agriculture and Fisheries - Miscellaneous Publications.

Life in the Sea - Johnstone - 1908.

Sea Fisheries, Their Treasures and Toilers - Herubel.

Treatise on China Clay - David Cock - 1880.

The Cornish Miner - Hamilton Jenkin - 1930.

Mining Magazine.

Tinfields of the World - Jones - 1925.

Copper - Crump - 1925.

Dewey - Copper Ores - 1923. Special Report on Mineral Resources of Great Britain.

Monograph on Tin Ores - Davies - 1919.

Annual Reports - Mines and Quarries 1910-30.

Mines and Miners - Burrows.

Mining Handbook - Skinner - 1930.

Cornwall, A Survey of Coast, Moors, and Valleys - W. Harding Thompson - 1930.

Blue Book on Cornwall, 1930 - Truro.

Cornish Mines and Miners - 1897. Thomas and Burrows.

Mining Journal.

Transactions English Ceramic Society - 1905.

American Pottery Gazette - 1907.

Transactions of Institute of Mining Engineers.

Cornish Chamber of Mines - Year Book.

British Mining - Hunt.

Tin Resources of British Empire - Penzer - 1921.

Moor - 1928 - Tin Mining.

Soils - Hilgard - 1918.

Bath and West of England - Agricultural Journal.

Tin and Tin Smelting in Malaya - British Empire Exhibition pamphlet - 1924.

Report of Tin and Tungsten Research Board 1922.

Tin dressing in Cornwall - Michell.

Thomas - Cornish Mining Interviews - 1896.

The Stannaries - G.R.Lewis.

Evolution of a Coastline - Ashton - 1920.

The Sea Coast - Wheeler - 1918.

Sea Fisheries - Jenkins - 1920.

Market Gardens - Woodward.

Quinn - Metal Handbook.

Mc.Intosh and Masterman - 1897 - British Marine Food Fishes.

J.C.Wilcocks - 1882 - History and Statistics of Pilchard Fishery in England.